FACTORS AFFECTING THE CONTENT OF BIOLOGY TEXTBOOKS WITH EMPHASIS UPON THE SUBJECT OF EVOLUTION

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Allan S. Williams, Major Professor

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FACTORS AFFECTING THE CONTENT OF BIOLOGY TEXTBOOKS WITH EMPHASIS UPON THE SUBJECT OF EVOLUTION

A Field Study

Presented to

the Faculty of the Graduate School

Austin Peay State University

In Partial Fulfillment

of the Requirements for the Degree

Education Specialist

by

Philip Chadwick

March 1996

DEDICATION

This field study is dedicated to my parents

Mrs. Virginia Hunt Chadwick

and

The late Mr. Millard Solomon Chadwick

who gave me something I cannot lose nor can anyone take from me--an education

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FACTORS AFFECTING THE CONTENT OF BIOLOGY TEXTBOOKS WITH EMPHASIS UPON THE SUBJECT OF EVOLUTION

An Abstract

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ABSTRACT

This field study was conducted to determine what factors affect the content of textbooks. The treatment of evolution will be used to study how these factors affect textbook content. The political and economic factors involved in textbook publishing possess important implications for the understanding of how and why textbooks contain the material which they contain.

This study involved a survey of forty-six introductory high school biology textbooks. The textbooks covered the 1950's to the 1990's. The text placement by chapter of the topic of evolution as well as the number of pages devoted to evolution was examined.

The textbook placement of evolution in a 1950's biology textbook was determined to be at 86.35 percent within the textbook. In the 1990's textbooks surveyed, the average placement of evolution was found to be at 33.14 percent within the textbook. The study also revealed the percentage of the textbook given to the topic of evolution increased from 3.75 percent in the 1950's textbooks to a high of 9.17 percent coverage in the 1970's. Following a decrease in percentage to 6.55 percent in the 1980's, the amount of coverage given to the topic of evolution has risen to 7.08 in the 1990's textbooks surveyed.

The results of this study show a topic which once was placed well within the body of the textbook and to which minimal coverage was given, the coverage of the topic of evolution has greater emphasis placed upon it in textbooks of the 1990's by placement within the textbook and percent coverage given to the subject.

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Introduction

The textbook dominates the curriculum and the teaching practices of most classrooms today (Goldstein, 1978). According to O'Donnell (1981), as much as 90 percent of instructional time has been associated with the use of textbooks. These statements alone should reveal the importance of the content of the textbook

To understand the procedures involved in selecting the content of textbooks is of the utmost importance. As the textbook development process has become more politicized, the educational quality of textbooks has taken secomd place to ideological considerations (DelFattore, (1991). The textbook is an economic commodity as O'Donnell (1981) reports which shows school districts nationwide spending approximately one billion dollars annually on textbook purchases. Therefore, selecting textbooks has become a delicate, complicated business.

The treatment of certain subjects in biology textbooks often produces controversy. In the examination of textbooks, changes in content have become apparent. Allowing more coverate of certain topics in some textbooks whole other topics receive less coverage in the same textbook is often evident. Textbooks are frequently tailored in the treatment of the subject matter in order to avoid undue criticism from textbook adoption committees and potential protest groups.

The political and economic factors which are involved in textbook publishing possess important implications for the understanding of how and why textbooks contain the material they contain. Since the textbook is such an integral part of the classroom, discovering the policies which shape the content of textbooks is vitally important.

Statement of Problem

The purpose of this study is to analyze the treatment of the topic of evolution in secondary biology textbooks. The textbooks included in the study will span five decades. The textbooks will be analyzed to determine and compare the placement of the concept of evolution within the organization of the text. The amount of specific coverage in terms of chapter and page allocation will be determined. This study will also examine the manner of the terminology, whether theoretical or factual, used to describe evolution.

Definition of Terms

The following terms are defined as they are used in this study. Several terms which are used in this study have specialized meanings unique to this study.

"Censorship"---The removal or restriction of work from a potential reader or viewer.

"Closed adoption state"---One of the twenty-two states mandating a state level decision requiring local school districts to adopt textbooks from a state approved list of textbooks previously approved by a state textbook adoption committee. Duke (as cited in Wintringer, 1992) lists the following closed adoption states including:

Alabama	Georgia	Louisiana	Oregon
Arizona	Hawaii	Mississippi	So. Carolina
Arkansas	Idaho	Nevada	Tennessee
California	Indiana	New Mexico	Texas
Florida	Kentucky	No. Carolina	Utah
		Oklahoma	Virginia

"Controversial subject"---Textbook matter of such nature causing debate or dispute.

"Creation science"---A doctrine or theory holding that matter, the various forms of life, and the world were created by God out of nothing and usually in the way as described in Genesis.

"Elhi market"---A term used by publishers which refers to elementary and high school textbooks.

"Evolution"---The process by which modern organisms have descended from ancient forms.

"Financial capital"---The accruing of actual dollars for profit.

"Introductory high school biology textbook"---A textbook used in the first level high school biology course, usually the freshman or sophomore year.

"Left-wing activist"---A person associated with the liberal side of an issue.

"Natural selection"---The process proposed by Charles Darwin whereby those individuals well adapted to the environment survive and reproduce. These adaptations then become a part of the genetic make-up of the entire population.

"New Right"---According to Merriam Webster's Collegiate Dictionary, a political movement made up especially of Protestants opposed especially to secular humanism and concerned with issues especially of church and state, patriotism and abortion.

"Open adoption state"---One of the twenty-eight states not requiring local school districts to select textbooks from a pre-approved list of state adopted textbooks. These districts may adopt any title from any publisher. According to Duke (as cited in Wintringer, 1992), the open adoption states include:

Alaska	Maine	Nebraska	Rhode Island
Colorado	Maryland	No. Dakota	So. Dakota
Connecticut	Massachusetts	New Hampshire	Vermont

Delaware	Michigan	New Jersey	Washington
Illinois	Minnesota	New York	West Virginia
Iowa	Missouri	Ohio	Wisconsin
Kansas	Montana	Pennsylvania	Wyoming

"Pages devoted to evolution"---In this study any page containing photographs, tables or text related to the topic of evolution.

"People for the American Way"---Formed in 1980, PFAW is a leading organization in the United States opposing censorship.

"Pseudoscience"---A system of theories, assumptions, and methods erroneously regarded as science.

"Red in tooth and claw"---A term used by Ella Thea Smith to describe evolution in terms of the survival of the fittest because of predation by a predator.

"Right-wing activist"---A person associated with the conservative side of an issue.

"Secular humanism"---The belief that man is his own source of salvation and may, therefore, separate himself from the supernatural. A term used by the New Right during the 1980's.

"Symbolic capital"---The use of goodwill in providing a service which may later prove profitable.

"Textbook"---A literary work relevant to the study of a given subject.

"Textbook adoption"---The policies and procedures used by a local school district to purchase and to provide classroom textbooks for students.

"Textbook adoption committee"---A committee comprised of one or more of the following: teachers, administrators, school board members, and parents. The committee utilizes the policies and procedures set forth by a local school district to purchase and to provide classroom textbooks for the students within a given school district.

"Textbook protester"---Any group or individual not employed by the school district who publicly opposes the adoption of a selected textbook.

"Textbook publisher"---A person or corporation whose business is publishing textbooks.

"Total pages in textbook"---Pages containing the text of the subject matter included in the textbook. Glossaries, indexes, supplemental tables, and chapter outlines are excluded from the total pages in the textbook for purposes of this study.

Limitations of the Study

The limitations of this study will be confined, for the most part, to the holdings of the Austin Peay State University Woodward Library. The study will also be limited to the number of biology textbooks available for examination.

Chapter 2

Review of the Literature

Factors Regarding Textbook Publishers

The textbook is an economic commodity which is bought and sold in the United States in an intense, competitive market. Because of this market, the textbook is subject to stringent competition which is affected by the pressures of making a profit. The textbook is not only an economic product but is also a political one (Apple, 1990). Textbook publishing is regulated at many levels with decisions on the publishing of textbooks frequently conditioned by government policies. In addition, different classes, races, genders, and religious groups are a part of the decisions governing textbooks.

Apple (1990) states that publishing is a business with the goal of making a profit. Methods publishers utilize in making their profits and in accumulating capital are varied. As a result, financial capital as well as symbolic capital exists. Oriented to rapid turnover and quick obsolescence, some publishing firms are geared to the minimization of risks and, therefore, are following a strategy for the accumulation of financial capital. Safe books and short-term profits are important to publishing firms; however, not all publishers operate with this in mind. The publishers who wish to accumulate symbolic capital work in a longer time perspective. Because immediate profit is less important to these publishers, higher risks are taken with experimental or provocative form and with content more readily accepted.

Because of the market conditions in textbook publishing in addition to the individuals in the publishing business and the political controversies involving the school curriculum, most textbook publishers follow a strategy based on financial

capital. This strategy has a major impact on which books are published and on the knowledge which is considered legitimate to teach in the classrooms of America (Apple, 1990).

Apple (1986 as cited in Apple, 1990) reports the 1980 total sales of publishing companies at six billion dollars. Sales totaling $1.5 billion have been reported from the elementary, secondary, and college textbook market alone. The increased concentration of power in textbook publishing has been considerable while competition among textbook companies has increased in recent years. This competition has been among a small number of larger firms and has reduced the propensity to take risks. Instead, many textbook publishers now prefer to expend most of their efforts on a small selection of more carefully chosen products (Coser, Kadushin, and Powell, 1982).

The concentration within textbook publishing reveals seventy-five percent of the total sales of college textbooks is controlled by the ten largest textbook publishers while 90 percent of the sales is accounted for by the top twenty textbook publishers. Prentice-Hall, McGraw-Hill, the CBS Publishing Group, and Scott-Foresman, the top four publishers, account for 40 percent of the textbook market according to Coser et al. (as cited in Apple, 1990).

In the "elhi" market, the textbook publishing figures are also revealing. The four largest textbook publishers of elementary and high school materials are estimated to account for 32 percent of the textbook market with the eight largest publishing firms controlling over 75 percent of textbook sales according to Goldstein (as cited in Apple, 1990).

Because of district, system, or state imposed restrictions on the titles which are allowed to be bought, textbook publishers are often limited in their sales; moreover, in twenty-two states all textbooks are listed and approved by a central

state agency (Compaine, 1978). These states which must buy from pre-approved lists in order to be reimbursed for their purchases are called closed adoption states.

Teachers at all educational levels have been trained to follow curricula organized around textbooks; however, elementary and secondary teachers in particular are taught the importance of textbook usage. To aid in obtaining consideration for their textbooks, publishers establish built-in course outlines, pre-tested reading levels, and teachers' guidebooks as well as suggested examinations for teachers' use in conjunction with the textbooks.

Based on the fact that textbook publishers produce a relatively few number of textbooks compared to the larger number of fiction produced by publishers, considerable pressure exists with the editorial staff of textbook companies to guarantee the sale of textbook (Coser et al., 1982). In order for the elhi marker to break even, the investment and the risks involved in the elhi market are illustrated by the fact that a decade ago one hundred thousand copies of a textbook must have been sold for every $500,000 committed by the publisher of a textbook (Goldstein, 1987).

Ideological uniformity or a political agenda is not what accounts for ideas which eventually are found or omitted in textbooks. Rather, the infamous "bottom line" is the important factor. Ultimately, censorship, if imposed, concerns profitably. Textbooks which are not profitable regardless of their subject matter are not viewed favorably (Cosec et al. 1983)

Applying even more pressure on textbook publishers are the twenty-eight open adoption states. These open adoption states do not require districts to select textbooks from established lists in order to be reimbursed for a portion of their purchases. The publishers sell textbooks directly to the school district. Through

the publishers' methods of presentations and "freebies" offered, publishers pursue the local textbook committees for approval and adoption.

Factors Regarding Adoption Committees

One of the greatest factors determining the content of a textbook is the textbook adoption committee. Although there is no national government sponsored curriculum, the structure of an unofficial curriculum is produced partially by the marketplace and partially by state adoption committees. Duke's study (as cited in Wintringer, 1992) indicates there are twenty-two closed adoption states which make state level decisions. The closed adoption states require each local school district to select textbooks from prescribed lists of options which are determined by the states' textbook adoption committees. Textbooks for use in the core curriculum are approved by state adoption committees. If local school districts select material from a state approved list, the districts are reimbursed a significant portion of the purchase cost (Apple, 1990). Because of this state reimbursement, local districts have a great deal to gain financially by choosing an approved textbook.

Because of good business practices, textbook publishers must by necessity aim their publishing practices toward the states with adoption policies (Apple, 1990). Publishers know Texas and California account for as much as 20 percent of the total sales of a textbook (Apple). Twenty percent of total sales is a considerable share of the market; thus, the political environment and ideological climate of these states often determine the content and the form of the curriculum. Keith (as cited in Apple, 1990) notes that publishers want assurance their books will sell before they commit large budgets to publishing a work. For example, Apple provides the following:

> In a California creationism vs. evolutionism controversy, where a group of "scientific creationists," supported by the political and ideological right sought to have all social studies and science texts give weight to creationist and evolutionary theories. Even when California's Board of Education, after much agonizing and debate, recommended "editorial qualifications" that were supposed to meet the objectives of creationist critics of the textbooks, the framework for text adoption was still unclear and subject to different interpretation. Did it require or merely allow discussion of creation theory? Was a series of editorial changes that qualified the discussion of evolution in the existing texts all that was required?
>
> Given this ambiguity and the volatility of the issue in which the "winning position was unclear, publishers resisted undertaking the more substantial effort of incorporating new information into their materials. Faced with an unclear directive, and one which might be reversed at any moment, publishers were reluctant to invest in change. They eventually yielded to the minor editorial adjustment adopted by the board but staunchly resisted the requirement that they discuss creation in their social science texts (p. 286).

Factors Affected by Authors' Viewpoints

The authors or editors who are discussed in this section have been selected for their varied viewpoints and treatments of evolution. For example, Truman Moon's series entitled Modern Biology is known to have conservative views of the subject of evolution. On the other hand, Ella Thea Smith is an example of an author whose ideas on evolution have changed considerably as one compares her books of two decades. Her inclusion of evolution from the 1950's to the 1960's has more

than doubled in content; moreover, her explanation of evolution has changed from an external mechanism to an internal mechanism. In addition, other series of textbooks such as those entitled Biological Sciences Curriculum Study or BSCS are written to present biological science topics totally from an evolutionary standpoint.

Truman J. Moon has been involved in the writing of ten biology textbooks published between 1921 and 1963 entitled Modern Biology. Since 1965 Moon's name has been dropped as senior author of the series; however, until 1991 the textbook, still bearing the name Modern Biology, has been patterned after the conservative style developed by Moon and his co-author James Otto. Thus, the influence of Moon and Otto has continued through the early 1990's. Having remained a conservative biology textbook throughout the authorship of Truman Moon as well as the co-authorship of Moon and James Otto, Modern Biology makes a dramatic change, however, in its approach to the topic of evolution under the authorship of Albert Towle. As the traditional, conservative influence of Moon and Otto has waned, Towle has led Modern Biology into a liberal viewpoint concerning the treatment of evolution.

Prior to the 1965 edition of Modern Biology, the chapters on evolution are placed either third or fourth from the last chapter in textbooks containing fifty or more chapters. The possibility exists for teachers who teach consecutively straight through the textbook never to teach the chapter on evolution because of chapter placement. With a possible fifty-three chapters to cover, the 1965 edition of Modern Biology moves the subject of evolution to the thirteenth chapter. The likelihood of a teacher teaching the subject of evolution has greatly increased by 1965.

The revisions in the 1965 Modern Biology textbook are the least conservative changes and result in a greater number of evolutionary subtopics being discussed in depth (Skoog, 1969). From surveying the treatment of the evolutionary

subtopics, evidence would suggest Truman Moon displays conservative ideas on the subject of evolution. As Skoog (1969) states,

> The fact that the textbooks authored by Moon and his co-authors were revised several times from 1921 through 1965 with only minor changes in their treatment of evolution indicates the textbooks must have been satisfactory to the many school systems and biology teachers continuing to adopt them (p. 299).

An example of a textbook writer with a liberal point of view regarding the treatment of evolution is Ella Thea Smith who has been involved in authoring six editions of Exploring Biology. According to Skoog(1969), the Exploring Biology series of the 1950's and 1960's tend to emphasize the concept of evolution to a greater extent than do earlier textbooks written by the same author. Smith (1959) defines evolution as "an unfolding, a term used by biologists to designate genetic changes in organisms throughout geologic time" (p. 663).

Ms. Smith's views on natural selection have changed from 1939 to 1966 (Skoog, 1969). In 1939 and 1943 her discussion of natural selection is flavored with the "red in tooth and claw" view referring to a prey and predator relationship. In the 1949 Exploring Biology textbook, the struggle among organisms' survival is taken out of natural selection with the concept of natural selection explained in terms of non-random reproduction (Skoog). In the 1966 Exploring Biology textbook, Smith develops the idea of embryological structures acting as organizers leading to common embryological features among closely related organisms (Skoog).

According to statements in the preface of three textbooks authored by Curtis and Urban (as cited in Skoog, 1969), all three textbooks tend to be conservative in the treatment of the concept of evolution (Skoog, 1969). Because of the small

amount of subject matter dealing with the treatment of evolution in these three textbooks, Skoog further notes that Curtis and Urban do not acknowledge or explain evolution as a major principle of the biological sciences.

Better known as BSCS, perhaps no series of biology textbooks have been as controversial as the Biological Sciences Curriculum Study textbooks. These biology textbooks have from their inception been authored by a consortium of biology teachers. By some standards, subject matter contained within these textbooks is so contested the textbooks are not adopted while in other cases, objections have been raised which result in subject matter being altered. Skoog(1969) notes the 1963 edition of BSCS Blue Version "concluded that biologists considered man to have evolved from forms of life which were nonhuman" (p. 262). Black (as cited in Skoog, 1969) reports Texas officials objected to the work *nonhuman*, and the statement is subsequently changed. Additionally, the 1963 BSCS textbook states, "It is no longer possible to give a complete or even coherent account of living things without the history of evolution" (p. 207). In the 1968 BSCS textbook the word *coherent* is removed, and the word *theory* is substituted for the word *history*. Small as these changes may appear to be on the surface, the objections in various sections of the United States concerning the 1963 BSCS Blue Version may have been productive in bringing about minor changes in the content of evolution.

Ron Wooddy (personal communication, March 18, 1996), Tennessee sales representative for Holt, Rinehart, and Winston, has assured this author his company does not tailor textbooks for any particular region of the country. Authors do, however, develop materials which will be acceptable to the public; thus successful sales for the publishers are insured. Textbooks, such as Moon's, and the later editions written by his co-authors Mann and Otto have been extremely successful in more conservative areas of the nation.

Factors Affected by Textbook Protest Groups

With total sales amounting to approximately one billion dollars annually, seven publishing firms control nearly 60 percent of the overall sales contracts for the entire textbook industry (Wintringer, 1992). In hopes of acquiring sales in the densely populated states, publishers work extremely hard to avoid offending potential textbook protesters. DelFattore (as cited in Wintringer, 1992) maintains pressures from textbook protesters cause publishers to delete as well as to change textbook contents particularly in the areas of high school textbooks.

Textbook protesters are able to apply pressure to all levels of the textbook industry. Protesters have made an impact not only on what materials are included in textbooks but also on which textbooks appear in classrooms (Wintringer, 1992). To understand who these protesters are and why they oppose material covered in certain textbooks is vital to understanding why textbook protesters have such an impact on textbook publishing.

According to Jenkinson (as cited in Wintringer, 1992), textbook protesters are primarily parents and special interest groups; however, these groups may also include students, clergymen, school board members, and district personnel. Jenkinson estimates that today there are at least two thousand organizations on the national, state, and local level protesting textbooks and teaching materials.

Sloan (as cited in Wintringer, 1992) describes textbook protesters as having four major characteristics in common. These protesters' demands include editing that with which they disagreed, making themselves judges for what is morally acceptable to society, making themselves judges for what is politically acceptable to society, and espousing secrecy.

LaPota and LaPota (as cited in Wintringer, 1992) have attempted to design a profile of the textbook protester. Neither political affiliation nor socio-economic

status has appeared to be a common factor. However, strong church attendance has proved to be an indicating factor with protesters basically including Baptists, Methodists, and Catholics. The protesters are more often reared in small towns or rural areas, are inclined to be middle-aged, and are prone to be in the middle-income bracket, moreover, most textbook protesters' formal education is limited to a high school diploma with a few protesters having obtained college degrees.

A major goal of textbook protesters is to mandate that schools stop the teaching of all the tenets of secular humanism including sex education, evolution, and values clarification. Bates (1993) reports most textbook protesters originate with the conservative sector of society. Contrary to what censorship experts believe, nevertheless, this is not because conservatives alone seek to inject their views into the classrooms. Liberals are no less eager to shape textbooks; however, they merely go about the process differently.

Bates (1993) further discusses the inconsistency of the treatment of conservative activists and liberal activists in a review of the testimony of the 1980's lawsuit Mozart v. Hawkins County Board of Education concerning the Holt, Rinehart, and Winston's basal reading series. Activists from both sides of the issue have inundated Holt editors with various types of complaints. The difference in the publisher's reactions to the complaints has been how the complaints have been treated. At Holt, Rinehart, and Winston publishers, the liberal activists have been viewed sometimes as irritating, occasionally as perplexing, but almost always right-thinking. On the other hand, conservative activists have been viewed as a dangerous and paranoid minority. Liberals have been welcomed into the offices at Holt, Rinehart, and Winston; however, conservatives have usually been kept at a distance. When conservatives have been brought into the offices to discuss their

concerns, the conservatives have been viewed with a mixture of wariness and contempt (Bates, 1993).

As the Holt textbooks have veered further leftward, conservatives have complained more and more about the content of the textbooks. Lacking the same access as their left-wing counterparts, the right-wing activists have resorted to the political process in which they have been viewed as censors. Bates (1993) says that textbook protests more often come from conservatives because liberals, who are not necessarily tolerant of ideas which differ from their own, have found a much better way to influence textbook publishing. While conservatives are loudly lobbying elected officials after textbooks have already been published, liberals are collaborating with textbook editors as textbooks are being written. Largely, the clamorous and occasionally successful "censors" of the right-wing are reacting against the hushed and most often successful positive pressure groups of the left-wing (Bates, 1993).

A case in point is the action of Tennessee State Senator Tommy Burks whose Senate Bill number 3229 was introduced into the Tennessee State Legislative Session of 1996. Burks' legislation is an act to amend Tennessee Code Annotated relative to the teaching of the theory of evolution. The bill states that "no teacher or administrator in a local education agency shall teach the theory of evolution except as a scientific theory. Any teacher or administrator teaching such theory as fact commits insurbordination, as defined in [TCA] and shall be dismissed or suspended as provided in [TCA]" (Burks, 1996, unp.). Although this proposed legislation failed in the Tennessee Legislature, the bill has helped to focus attention on specific subject matter being taught in Tennessee public schools thus sending a message to publishers pertaining to the type of science material acceptable to state adoption committees.

Phyllis Schafly, Concerned Women for America led by Beverly LaHaye, and Citizens for Excellence in Education represented by Robert L. Simonds. These groups are only three of the many organizations belonging to the group to which Bates (1993) refers as the New Right.

Groups comprising the Left are most notably the National Center for Science Education and the People For the American Way. Since 1985, the People For the American Way has begun releasing a review of biology textbooks. This review has been started to examine the controversial issue of whether evolution should, in fact, be taught and how the subject should be taught. In addition to the review, People For the American Way has issued a report card for biology textbooks linked to a textbook's coverage of evolution. The 1990 report card review of the PFAW includes the following:

> The purpose of this review is to gauge how successful this response has been at convincing publishers that teachers, parents, and state education leaders want biology textbooks that do not compromise science for sectarian ideology or confuse scientific process with religious conviction. In addition, this review is designed to assist textbook selection committees across the country as they choose the next generation of biology texts for their schools (p. 3).

Through intensive lobbying efforts, the People For the American Way have greatly influenced textbook publishers. Additionally, the group has inspired writers to add more coverage and emphasis on evolution to their textbooks. A spokesman for the People For the American Way further states:

> The principle finding of our reviews is positive; evolution is back in biology textbooks in an unabashed and uncompromising way. The contrast with our findings five years ago could not be more dramatic. In 1985, publishers practiced self-censorship, diluting evolution or omitting it altogether. In

1990, all nine textbooks reviewed present in-depth coverage of evolution across a wide range of topics in biology. 'For now, the 'dumbing-down' of evolution has stopped; these texts have been 'smartened-up'" ("Biology Textbooks," 1990, p. 6).

Chapter 3

Method of Study

Description of Study

This study involved a survey of forty-six introductory high school biology textbooks selected solely by availability. The textbooks were representative of those which were published during the 1950's through the 1990's. The textbooks came from a variety of sources including personal collection, the Dickson County Senior High School Library, the Dickson County Senior High School Science Department, and textbooks belonging to colleagues from other schools. A list of the textbooks included in this study may be found in Appendix A.

While examining the textbooks, they were randomly stacked in order to mix the publication dates. A survey form, included in Appendix B, was completed on each textbook. Each textbook preface or introduction was examined for an explanation of the theme of evolution as presented in the textbook. Each textbook was examined for an explanation of how controversial subjects were presented in the text. The text placement of the subject of evolution was determined as well. The number of pages devoted to the subject of evolution was determined. The number of pages devoted to the subject of evolution was established, and the total number of pages of text for each book was also recorded. Further, the textbooks were surveyed to ascertain if special creation or creation science was included or mentioned in the text.

Research Design and Procedures

In order to prevent the skewing of data, the textbooks were randomly stacked by publication dates. A survey form was developed to analyze the content and presentation of evolution within each book. During the survey, the publication date for each textbook was the last information obtained and recorded on the survey form.

The preface to each textbook and the introduction to each chapter on evolution were examined for a possible explanation of how evolution was presented in the textbook. In either the preface or introduction, certain authors gave an explanation of how evolution was treated in their textbook; however, if the term *evolution* appeared only a list of topics covered in the textbook, no special notation was made.

The textbooks were reviewed to see if the author offered an explanation of the treatment of controversial subjects. This was done in the survey to determine if authors felt a need to explain their position or their approach to subjects which adoption committees or reviewers might consider controversial.

This study involved the chapter placement within the textbook of the coverage of evolution. The location in the text was used to determine the level of importance given to the subject. Further, to indicate the degree of importance given to evolution, the number of pages devoted to the topic of evolution as compared to the total number of pages in the textbook was determined. This was patterned after a method prescribed by Rosenthal (1985). The percentage of total text devoted to evolution was calculated for each textbook by the following formula: the number of pages of text devoted to evolution/ total number of pages in text x 100. The determination of total number of pages in each textbook excluded the glossary, the index, and the supplementary material. Illustrations and photographs were counted

in total page numbers in this study since the author was using them to place emphasis on the topics covered in the chapter.

The prefaces and chapter introductions were examined to see if the author included or described a position toward special creation or creation science. The manner in which the author viewed the subject of evolution was determined. The text was examined to see how the author used the term *evolution*.

Chapter 4

Results

Textbooks of the 1950's

No textbook surveyed had any explanation of the theme of evolution as presented by the author. Neither was there an explanation given of the treatment of controversial subjects within the textbook.

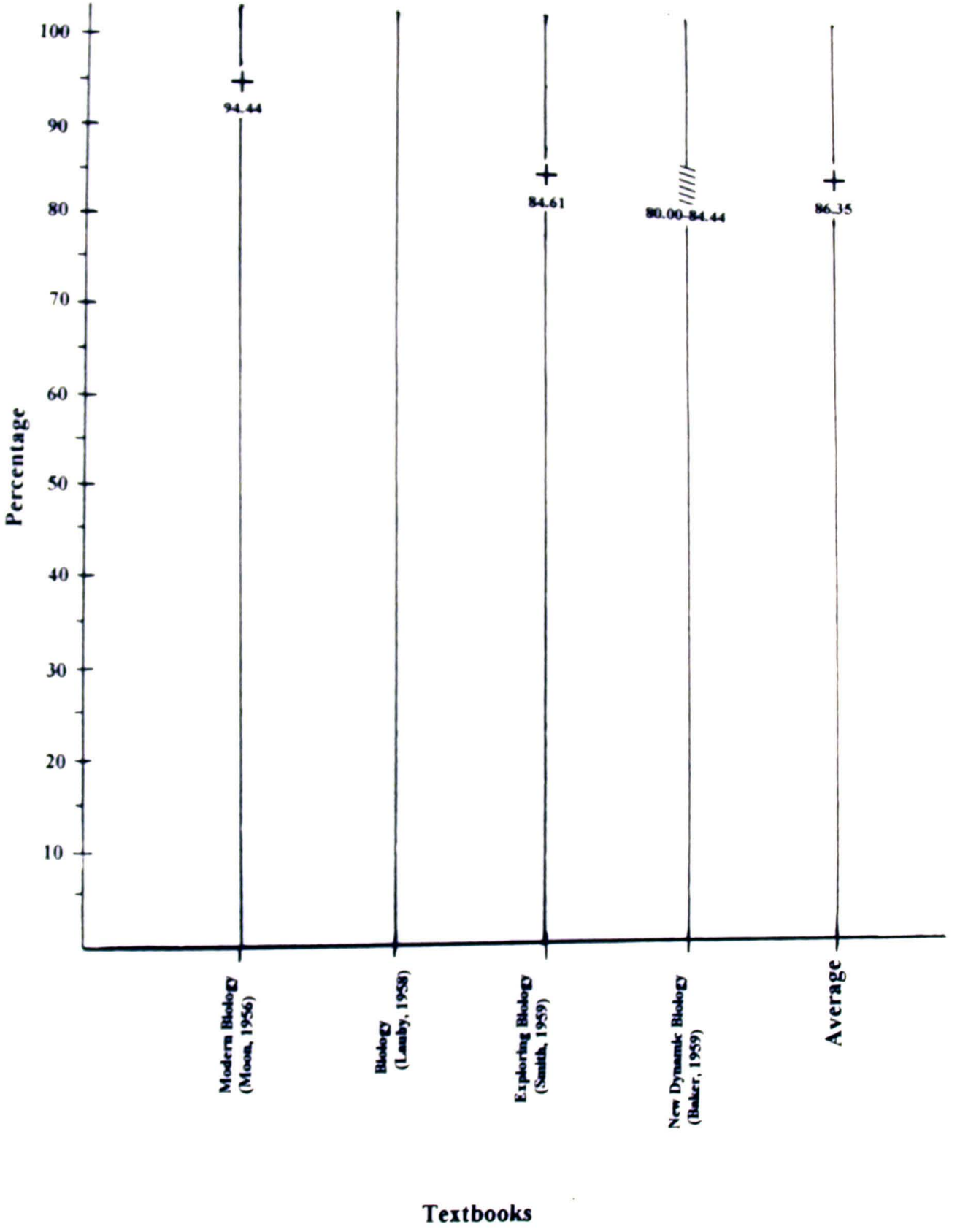
Graph 1 illustrates that one of the four books surveyed did not include the topic of evolution at all. In two textbooks, Modern Biology (Moon, Mann, and Otto, 1956) and New Dynamic Biology (Baker, Mills, and Tanczos, 1959), the term *evolution* did not appear in the text, glossary, or the index. In Exploring Biology (Smith, 1959) the term *survival of the fittest* was used in reference to evolution. In New Dynamic Biology (Baker et al.) and in Modern Biology (Moon et al.) the term *natural selection* was ascribed to evolution.

Graph 1 illustrates the chapter placement of evolution within the biology textbooks of the 1950's. Table 1 reveals that Modern Biology had the lowest percentage of coverage of evolution while New Dynamic Biology contained the greatest percentage of coverage of evolutionary topics.

Table 1
Percentage Of Textbook Devoted To Evolution--1950's

Textbook Name	Total Pages	Evolution Pages	Percentage
Modern Biology(Moon-56)	713	13	1.82
Biology(Lauby-58)	624	-0-	-0-
Exploring Biology(Smith-59)	652	27	4.14
New Dynamic Biology(Baker-59)	366	30	5.30
	Average	23.33	3.75

Graph 1
Chapter Placement of Evolution Within Biology Textbooks--1950's



Graph 2
Text Placement of Evolution Within Biology Textbooks--1950's

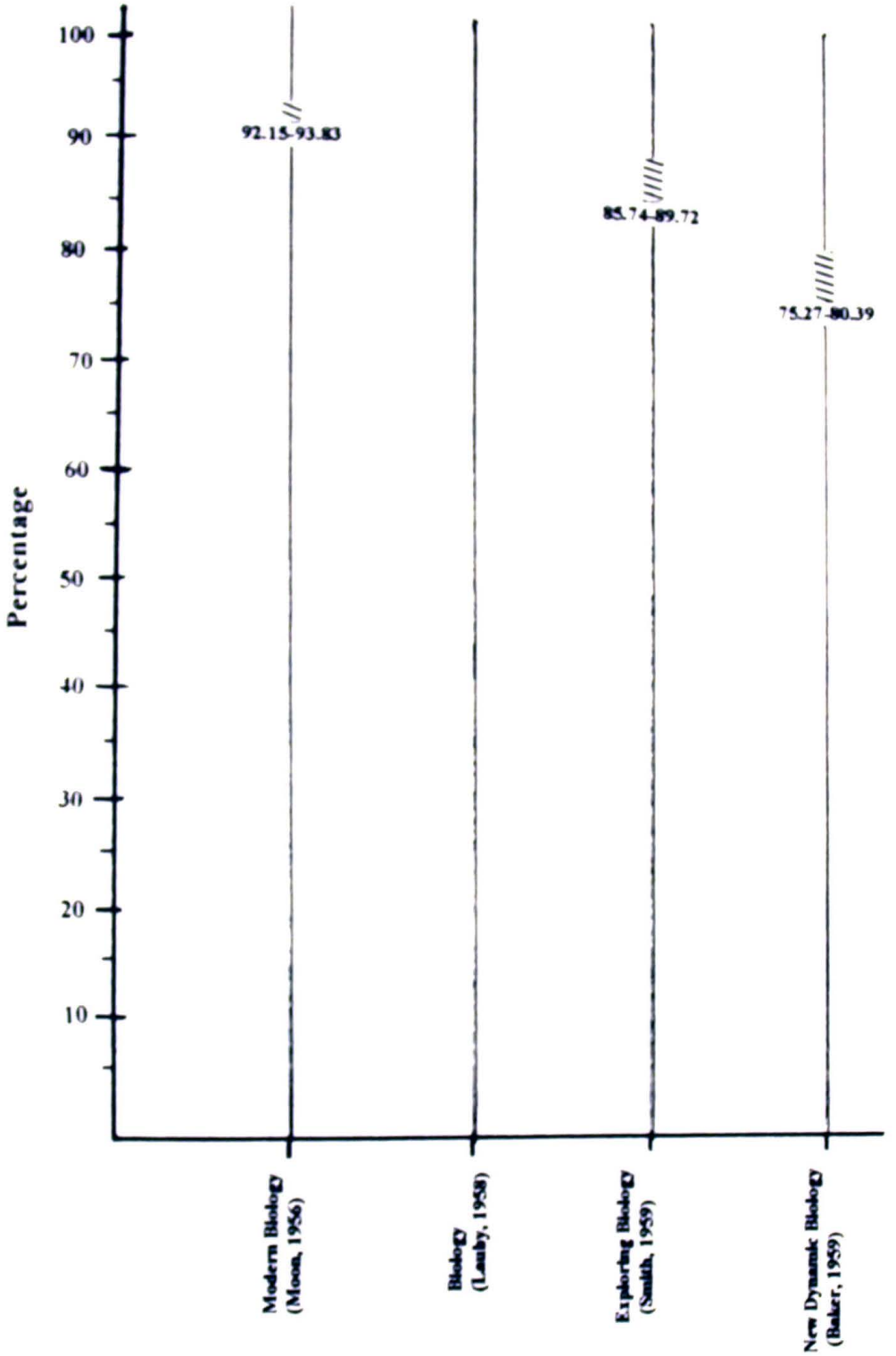


Table 2
Chapter Placement Of Evolution Within
The Biology Textbook--1950's

Textbook	Placement(Chapter or Section)
Modern Biology(Moon-56)	51 out of 54
Biology(Lauby-58)	No Mention of Evolution
Exploring Biology(Smith-59)	22 out 26
New Dynamic Biology(Baker-59)	36, 37, and 38 out of 45

Table 2 represents the chapter placement of evolution within the textbooks surveyed for the 1950's. Modern Biology and Exploring Biology included only one chapter in their textbook covering the topic of evolution. This information is conveyed on Graph 1 by the points listed for these two books. New Dynamic Biology used three consecutive chapters to discuss evolution. These three chapters occupied the span of 80.00 to 84.00 percent coverage as revealed on Graph 1.

Graph 2 illustrates the text placement of evolution within the biology textbooks surveyed for the 1950's. This graph emphasizes again the amount of coverage of evolution and its placement within the text.

Of the four textbooks surveyed for the 1950's, only Modern Biology (Moon et al., 1956) referred to special creation. The textbook included a topic called "Science and Religion" which contained the following:

> "Some people are concerned because they think science interferes with religion. There is nothing in all of science that in any way opposes a belief in God and religion. Thomas Huxley the famous English biologist who lived in Darwin's time wrote: 'Science seems to me to teach in the highest and strongest manner the great truth which is embodied in Christian conception of entire surrender to the will of God. Sit down before the fact as a little child, be prepared to give up every preconceived notion, follow humbly

of entire surrender to the will of God. Sit down before the fact as a little child, be prepared to give up every preconceived notion, follow humbly wherever and to whatever abysses nature leads, or you shall learn nothing. I have only begun to learn content and peace of mind since I have resolved at all risks to do this.'

A famous physician, the late Major W. W. Keene, M. D., whose professional training gives him a different point of view than the viewpoint of Huxley, wrote: "With the passing of years I am more and more impressed with the wonderful mechanism of nature, which to me bespeaks God" (pp. 667-668).

Textbooks of the 1960's

Of the twelve textbooks surveyed for the 1960's, two had an explanation for the coverage of evolution. In the 1963 edition of Biological Science: Molecules To Man edited by Claude Welch the following statement was made:

You will see how the theories of the gene, of the cell, and of evolution are

Table 3
Percentage Of Textbook Devoted To Evolution--1960's

Textbook Name	Total Pages	Evolution Pages	Percentage
Elements Of Biology(Dodge-62)	676	40	5.92
Biology For You(Vance-63)	622	21	3.38
Biological Science(Welch-63)	669	79	11.81
Biology(Kroeber-65)	605	48	7.93
Modern Biology(Otto-65)	741	17	2.29
Exploring Biology(Smith-66)	695	72	10.36
Biological Science(Welch-68)	779	102	13.09
High School Biology(Miller-68)	755	56	7.42
Biological Science(Gregory-68)	764	32	4.19
Biological Science(Meyer-68)	756	75	9.92
Modern Biology(Otto-69)	732	20	2.73
Biology(Nason-69)	751	68	9.05
	Average	46.83	7.34

merging into a single inclusive idea. The variety of living things is a fact, obvious to everyone. The evolution of living things is an idea, an attempt to explain the great variety of living things. As you study this unit, you will see how the facts of biological variation interacted with the ideas of biological evolution to provide some of our present knowledge. You will learn that the theory of evolution had an impact upon other ideas, ideas of how living things originate. You will begin to understand the nature of science--to see as a continual interplay between growing factual knowledge and developing ideas (p. ix)

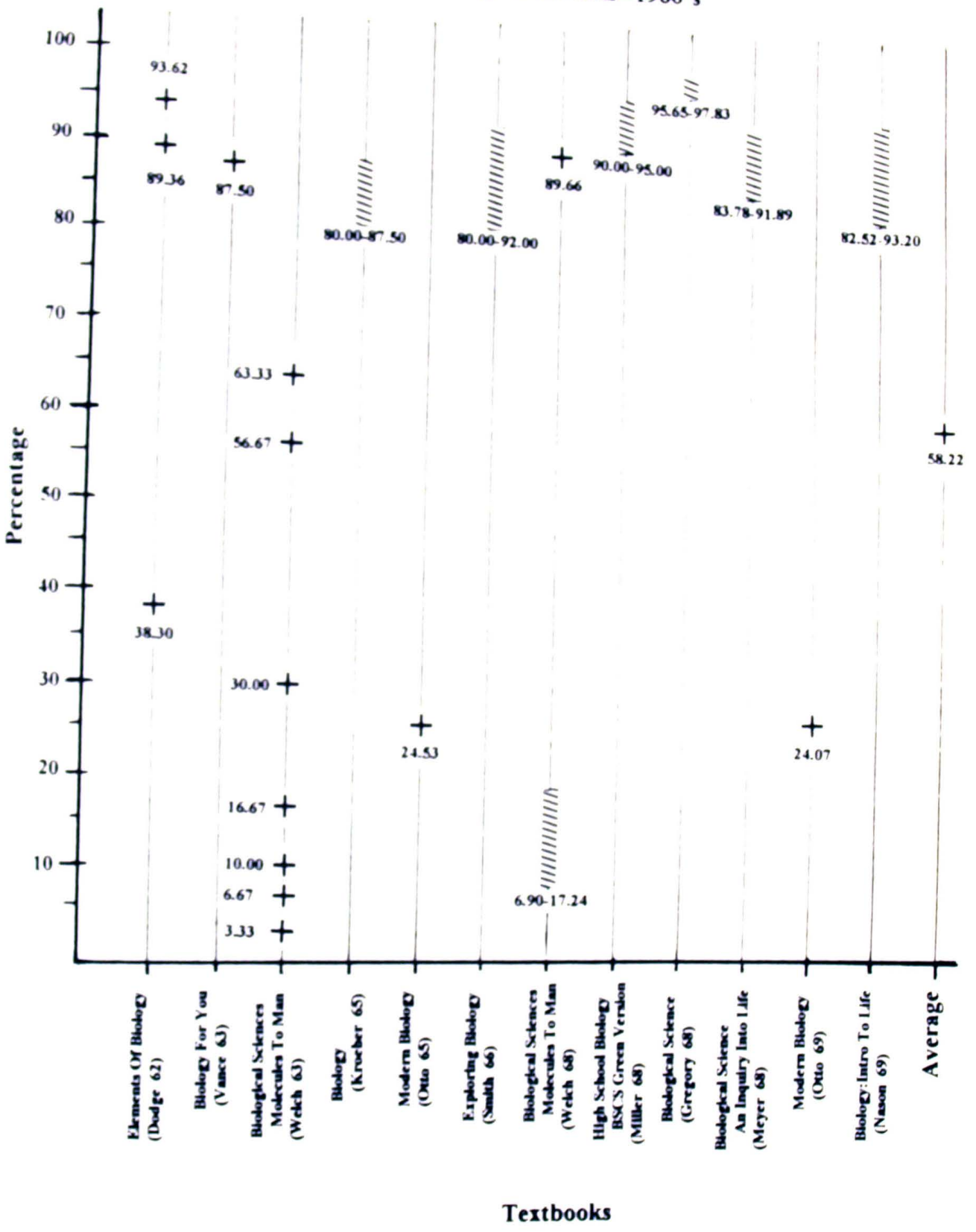
In the 1968 revisions of Biological Science, Molecules To Man, Welch's theme statement of evolution included, "Biology is a relatively young science. Basic biological ideas of evolution, genetics, and cell theory were formulated only about one hundred years ago. Because of the rapid pace of biological research, these ideas must be continually re-evaluated" (p. x)

Of the textbooks examined, none in the 1960's had an explanation of the

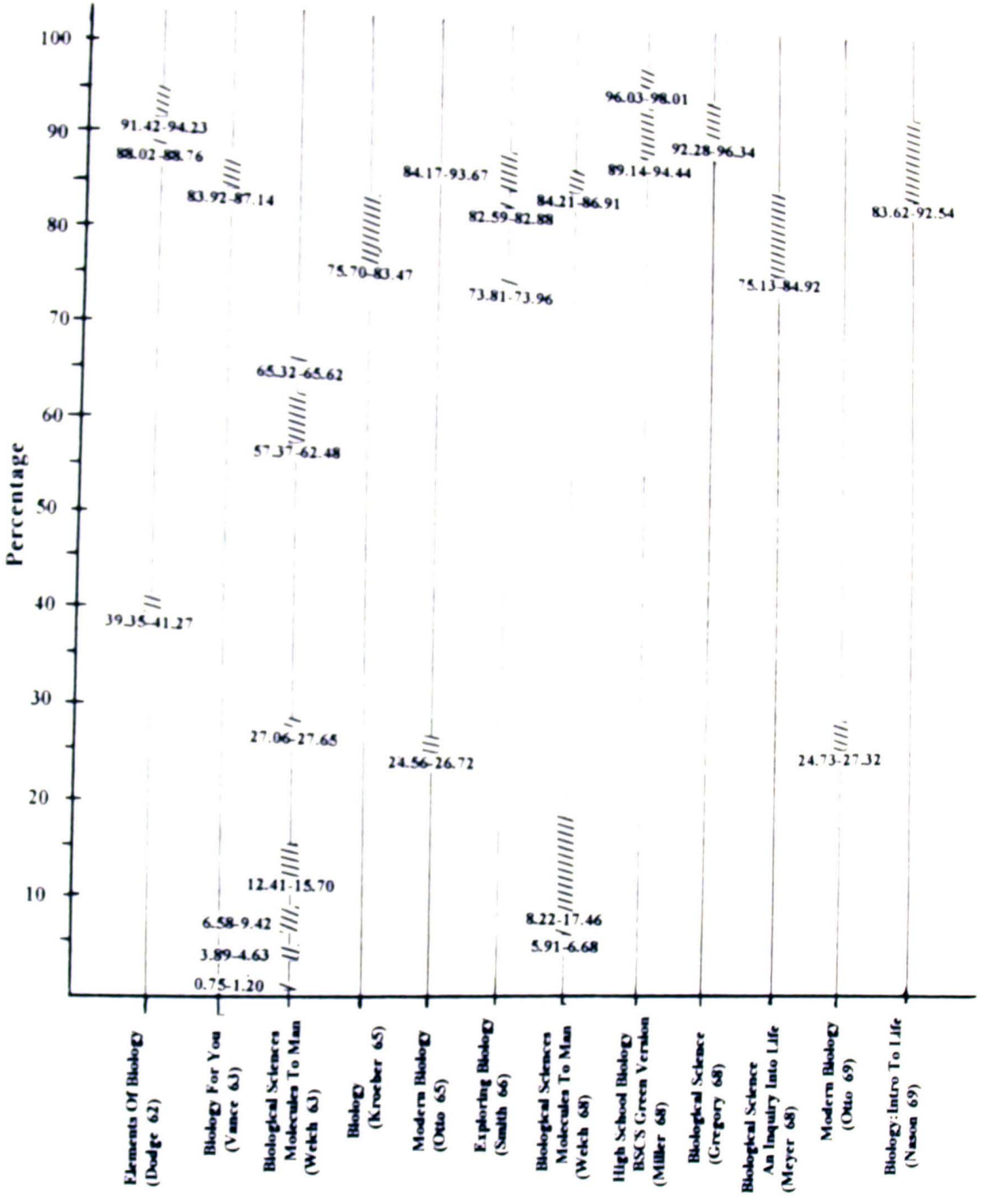
Table 4
Chapter Placement Of Evolution Within
The Biology Textbook--1960's

Textbook	Placement(Chapter or Section)
Elements Of Biology(Dodge-62)	18, 42, and 44 out of 47
Biology For You(Vance-63)	14 out of 16
Biological Science(Welch-63)	1, 2, 3, 5, 9, 17, and 19 out of 30
Biology(Kroeber-65)	32, 33, 34, and 35 out of 40
Modern Biology(Otto-65)	13 out of 53
Exploring Biology(Smith-66)	20, 21, 22, and 23 out of 25
Biological Sciences(Welch-68)	2, 3, 4, 5, and 26 out of 29
High School Biology(Miller-68)	18 and 19 out of 20
Biological Science(Gregory-68)	44 and 45 out of 46
Biological Science(Meyer-68)	31, 32, 33, and 34 out of 37
Modern Biology(Otto-69)	13 out of 54
Biology(Nason-69)	85 through 96 out of 103

Graph 3
Chapter Placement of Evolution Within Biology Textbooks--1960's



Graph 4
Text Placement of Evolution Within Biology Textbooks--1960's



Textbooks

controversial subjects covered in the textbooks. Two textbooks in the 1960's mentioned special creation or creation science. Biological Science (Gregory and Goldman, 1968) quoted from The Origin of Species (as cited in Gregory and Goldman, p 733), "There is grandeur in this view of life, with its several powers having been originally breathed by the Creator into a few forms or into one." Biology (Kroeber, Wolff, and Weaver, 1965) included the statement, "Many believe also that the theory of evolution leads to a clearer understanding of a divine plan for the earth and its creatures" (p. 459).

Table 3 gives the percentages of evolution coverage contained in the textbooks surveyed for the 1960's. Table 4 lists the chapter placement of the evolutionary topics within those same textbooks. Graph 3 shows the chapter placement of evolution within the textbooks surveyed for the 1960's. The observations made were that some textbooks began to include evolution in multiple locations throughout the text. Graph 4 illustrates the percentages of evolution coverage within the text of the 1960's textbooks.

Three textbooks of the 1960's, Biology For You (Vance and Miller, 1963), Biology (Kroeber, Wolff, and Weaver, 1965), and Biological Science (Gregory and Goldman, 1968) referred to evolution by use of the term *natural selection*. Gregory and Goldman (1968) referred to Darwin's theory of natural selection as "the backbone of modern evolutionary theory" (p. 721). The remaining books of the 1960's used the expression *theory of evolution*.

Textbooks of the 1970's

Eight of thirteen textbooks of the 1970's which were surveyed included some type of explanation for the treatment of evolution. Stating their coverage of evolution to be theory rather than fact were Biology: Living Systems (Oram,

Hummer, and Smoot, 1973), Biology: Living Systems (Oram, Hummer, and Smoot, 1979) and Biology An Inquiry Into the Nature of Life (Weinberg, 1977). Pathways In Biology (Oxenhorn, 1974) explained its coverage as a total picture of the variety of living things.

Kimball (1975) stated the survey of living things had been reworked in an evolutionary context and had been placed in the part of the book devoted to evolution. Tanzer (1977) in Biology and Human Progress explained his position on the subject of evolution by saying, "In this text, the treatment of this theory [evolution] makes a clear distinction between the evidences--for example, the fossil record upon which the theory is based and the theory itself" (p. v.).

The 1977 edition of Modern Biology (Otto, Towle, and Madnick) stated, "Evolution is defined and explored according to our present understanding of organic variation. The important contributions of Charles Darwin are examined. Darwin's theory of natural selection is explained. Students will better understand evolution and its effects on populations after reading this chapter" (p.22 [supplemental]).

Biological Science: An Ecological Approach (Haynes, 1973) referred to evolution as a possible explanation for the order that students could see within the great diversity of organisms. She further explained the theory of evolution was not discussed explicitly but might be assumed as a reasonable basis for interpreting the evidence. She concluded paleontologists had no direct evidence of how life originated; however, some biologists speculated about the origin of complex compounds.

Two textbooks in the 1970's referred to special creation. Biology: An Inquiry Into the Nature of Life (Weinberg, 1977) included a table listing twelve comparisons of creationists and evolutionists concerning evolution. Biology (Kimball, 1975) stated, "Darwin's Origin of Species presented a large number of

facts which Darwin felt could be best explained by a theory of evolution and could not be adequately explained by a theory of special creation" (p. 696)

Table 5 gives the percentage of each textbook devoted to the coverage of evolution. Table 6 shows the placement by chapter of where evolution is covered. Graphs 5 and 6 give the chapter placement and the text placement of evolution within the biology textbooks surveyed from the 1970's.

Seven of the thirteen textbooks mentioned evolution as a theory. Biological Science: An Ecological Approach (Haynes, 1973) and Biology And Human Progress (Tanzer, 1977) referred to evolution as the theory of natural selection. Biology (Smallwood and Green, 1974) stated, "Evolution is a theory and will always be a theory no matter how much evidence is accumulated in support of it" (p. 168). Smallwood and Green further stated:

> There were weakness in Darwin's theory which his antagonists soon discovered. Actually, if most of the opponents had read his book carefully, they would have found that Darwin himself had already pointed out and

Table 5
Percentage Of Textbook Devoted To Evolution--1970's

Textbook Name	Total Pages	Evolution Pages	Percentage
Modern Biology(Otto-73)	824	22	2.67
Biological Science(Haynes-73)	698	64	9.17
Biological Science(Welch-73)	747	99	13.25
Biology(Oram-73)	728	50	6.87
Biology(Smallwood-74)	694	60	8.65
Pathways In Biology(Oxenhorn-74)	578	34	5.88
Biology(Kimball-75)	864	171	19.79
Biology(Morholt-76)	364	52	14.29
Modern Biology(Otto-77)	712	15	2.11
Bio. And Human Prog.(Tanzer-77)	498	42	8.43
Biology(Weinberg-77)	540	64	11.85
Biological Science(Haynes-78)	728	74	10.16
Biology(Oram-79)	652	40	6.13
	Average	56.08	9.17

Graph 5
Chapter Placement of Evolution Within Biology Textbooks--1970's

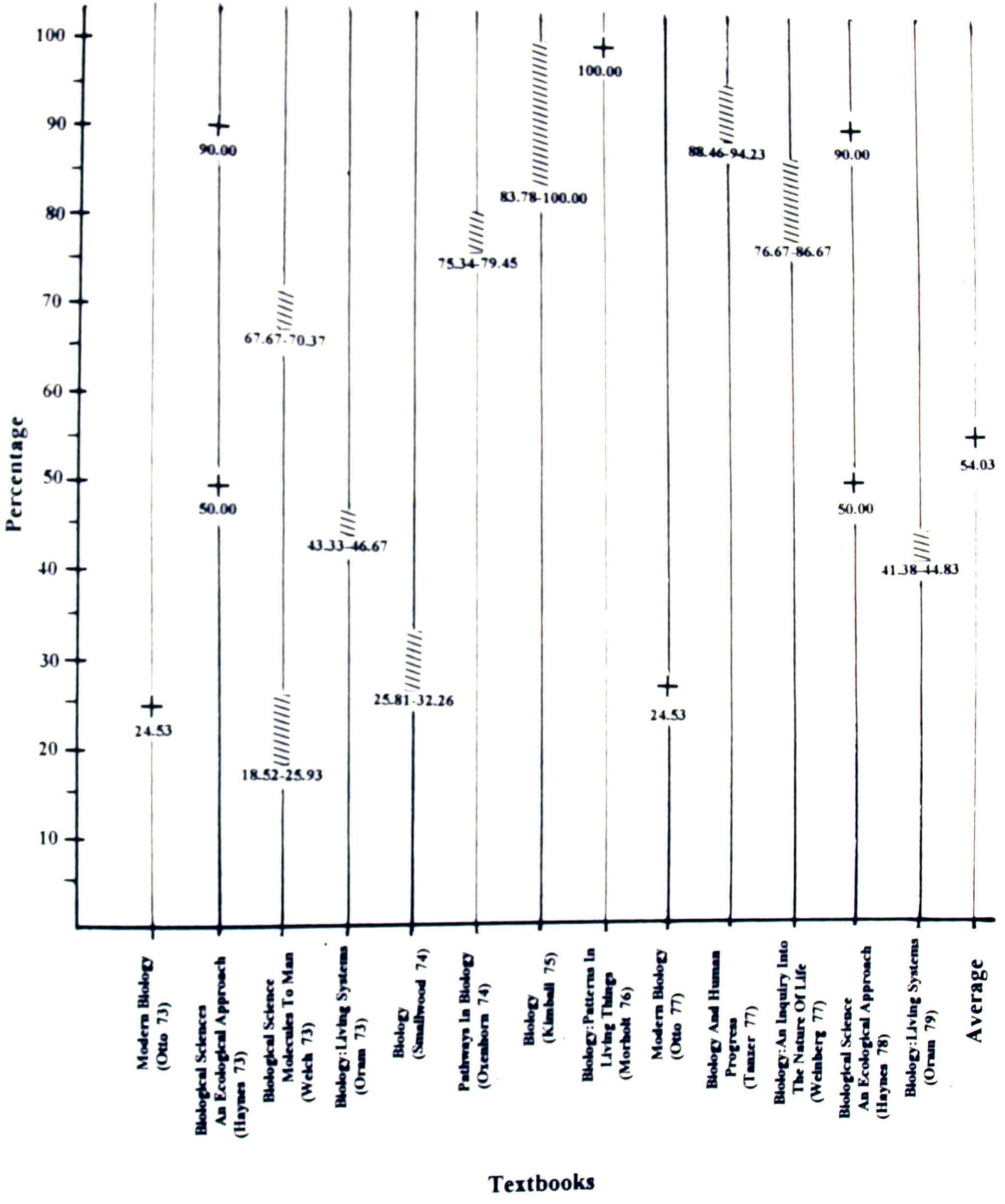


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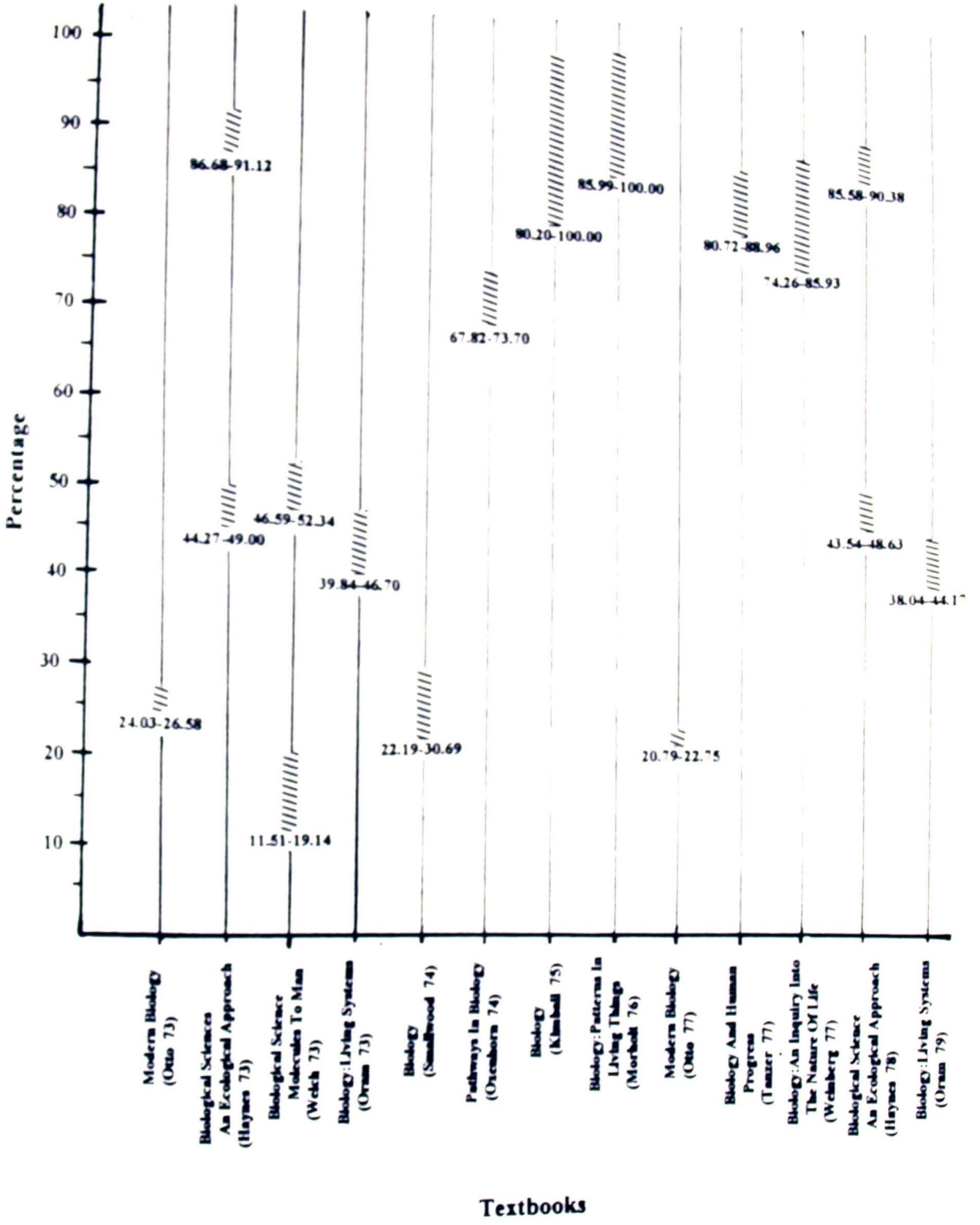
Table 6
Chapter Placement Of Evolution Within
The Biology Textbook--1970's

Textbook	Placement(Chapter or Section)
Modern Biology(Otto-73)	13 out of 53
Biological Science(Haynes-73)	10 and 18 out of 20
Biological Science(Welch-73)	5, 6, 7, 18, and 19 out of 27
Biology(Oram-73)	13 and 14 out of 30
Biology(Smallwood-74)	8, 9, and 10 out of 31
Pathways In Biology(Oxenhorn-74)	55, 56, 57, and 58 out of 73
Biology(Kimball-75)	31 through 37 out of 37
Biology(Morholt-76)	10 out of 10
Modern Biology(Otto-77)	13 out of 53
Bio. And Human Prog.(Tanzer-77)	46, 47, 48, and 49 out of 52
Biology(Weinberg_77	23, 24, 25, and 26 out of 30
Biological Science(Haynes-78)	10 and 18 out of 20
Biology(Oram-79)	12 and 13 out of 29

Graph 6
Text Placement of Evolution Within Biology Textbooks—1970's



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> There are weaknesses in Darwin's theory which his antagonists soon discovered. Actually, if most of the opponents had read his book carefully, they would have found the Darwin himself had already pointed out and discussed many of these weaknesses. At this time, more than a century later, it would by useless to discuss these weaknesses (p. 192).

Pathways In Biology (Oxenhorn, 1974) stated, "The new theory of change is called evolution and some people think evolution holds man descended from monkeys. *This is absolutely false and unscientific* [italicized in text] (p. 393). Biology: Patterns In Living Things (Morholt and Brandwein, 1976) spoke of evolution as, "All slow changes are called evolution. Evolution is the slow change that has taken place in the earth itself and in animals and plants" (p. 336).

The 1977 edition of Modern Biology (Otto, Towle, and Madnick) used the term *theory of natural selection* to describe evolution. Moreover, other concepts which were presented in this textbook were described as theories. In Biology (Oxenhorn, 1974) the coverage was explained as a total picture of the variety of living things.

Kimball (1975) in Biology stated the survey of living things had been reworked in an evolutionary context and had been placed in the part of the book devoted to evolution. Tanzer in Biology and Human Progress (1977) explained his position on the subject of evolution by saying, "In this text, the treatment of this

theory[evolution] makes a clear distinction between the evidences--for example, the fossil record upon which the theory is based and the theory itself" (p. v.).

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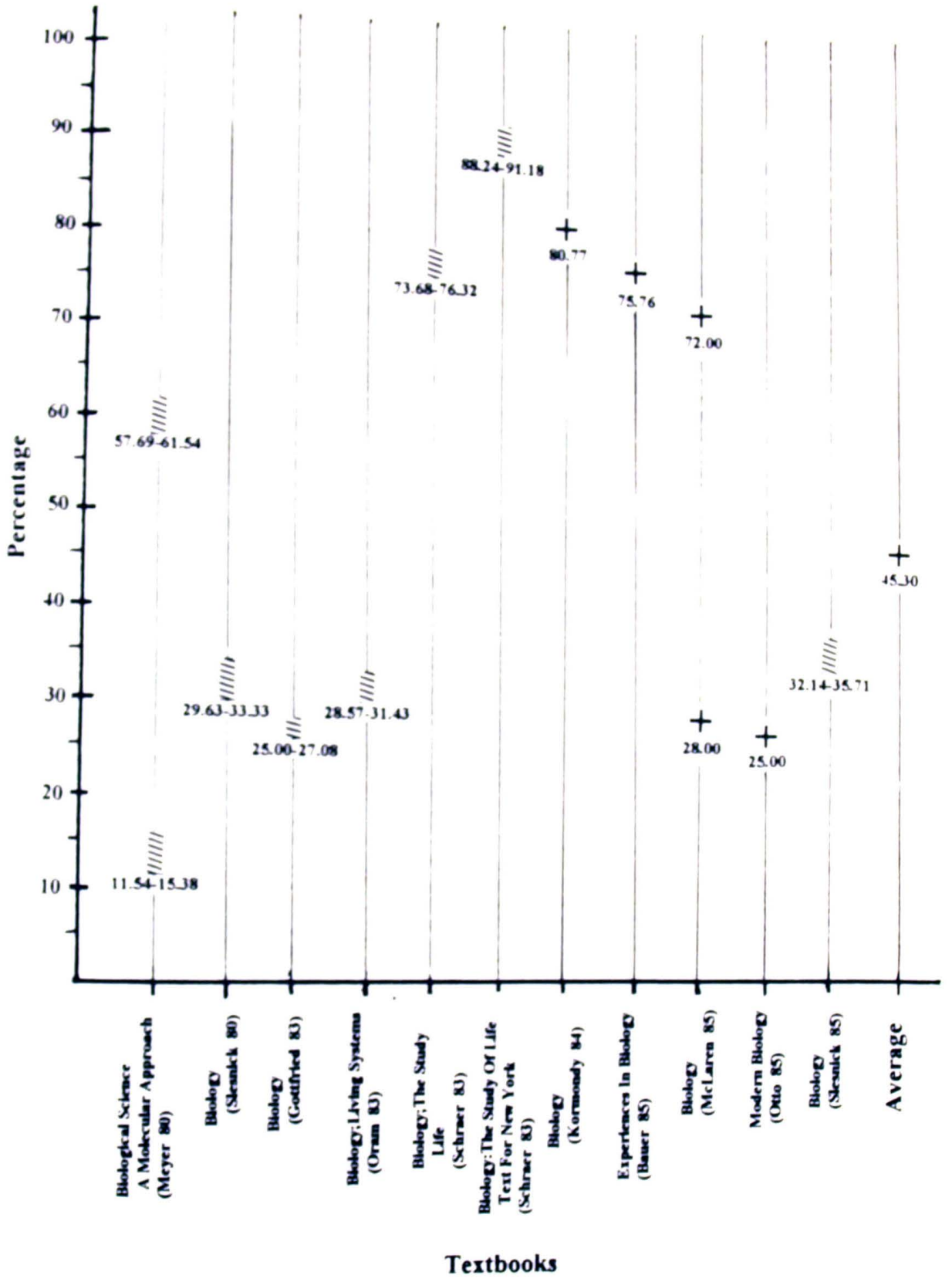
Textbooks of the 1980's

Three of the eleven textbooks surveyed commented on the presentation of evolution within the text material. Biology (Gottfried, Madrazo, Motz, Olenchalk, Sinclair, and Skoog, 1983) presented theories in "an intellectually honest way as scientists have conceived them. All theories are tentative and await further modification and refinement. This approach reflects the challenges and intellectual

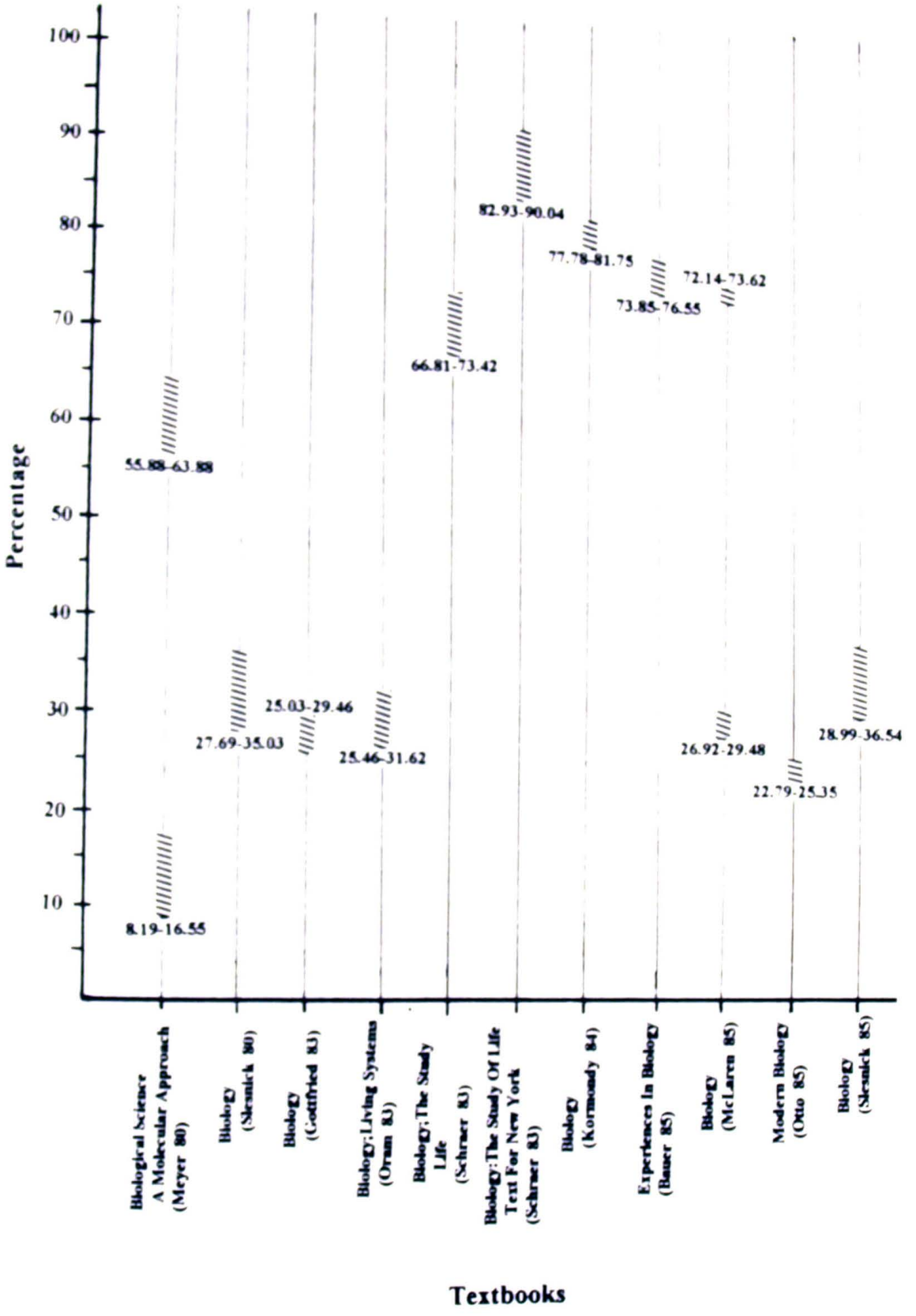
Table 7
Percentage Of Textbook Devoted To Evolution--1980's

Textbook Name	Total Pages	Evolution Pages	Percentage
Biology(Slesnick-80)	668	50	7.49
Biological Science(Meyer-80)	562	94	16.73
Biology-NY Text(Schraer-83)	492	36	7.32
Biology(Schraer-83)	681	46	6.75
Biology(Gottried-83)	791	36	4.55
Biology(Oram-83)	699	44	6.29
Biology(Kormondy-84)	756	31	5.38
Exp. In Biology(Bauer-85)	631	18	2.85
Biology(McLaren-85)	743	32	4.31
Modern Biology(Otto-85)	781	21	2.69
Biology(Slesnick-85)	676	52	7.69
	Average	41.82	6.55

Graph 7
Chapter Placement of Evolution Within Biology Textbooks--1980's



Graph 8
Text Placement of Evolution Within Biology Textbooks--1980's



rewards available to students in the ever-changing discipline of science" (p. 11).

In the preface to Biology, (Slesnick, Balzer, McCormack, Newton, and Rasmussen, 1985), evolution was explained as

> ...the theme of change, both in the past and ongoing. Scientists have developed the theory to explain how these changes happen. Evolution means a change in the genetic make up of a population over a period of time. Most scientists use the theory of evolution as a basis for formulating hypothesis and conducting research. This theory is important because it explains so many observations which have been made about organisms both alive today and the past (p. 197).

The authors summarized their opinions by stating that in Chapter 9 the reader will learn about the evidence for evolution and that in Chapter 10 the reader will discover how evolution might occur.

Biology (McLaren and Rotundo, 1985) gave the textbook's philosophy's in its preface by stating, "You will find the subject of evolution is treated in

Table 8
Chapter Placement Of Evolution Within
The Biology Textbook--1980's

Textbook	Placement(Chapter or Section)
Biology(Slesnick-80)	8 and 9 out of 27
Biology(Meyer-80)	3, 4, 15, and 16 out of 26
Biology:NY Text(Schraer-83)	30 and 31 out of 34
Biology(Schraer-83)	28 and 29 out of 38
Biology(Gottfried-83)	12 and 13 out of 48
Biology(Oram-83)	10 and 11 out of 35
Biology(Kormondy-84)	21 out of 26
Exp. In Biology(Bauer-85)	25 out of 33
Biology(McLaren-85)	14 and 36 out of 50
Modern Biology(Otto-85)	13 out of 52
Biology(Slesnick-85)	9 and 10 out of 28

nondogmatic manner. Every attempt has been made to provide scientific basis for the development of the theory" (p. 5T).

McLaren and Rotundo (1985) covered controversial subjects by including in their textbook the topic entitled "Distinguishing Between Fact and Fiction." They stated, "The skill is especially important in comprehending science material. A statement of fact describes something has been observed while an inference is an intelligent guess or conclusion based on observations" (p. 31T). McLaren and Rotundo also stated that Chapters 14 and 36, which dealt with evolution, presented especially good material for helping students to make distinctions between a statement of fact and an inference.

Table 7 lists the percentages of evolutionary coverage for the textbooks surveyed for the 1980's. Table 8 lists the chapters in each textbook containing evolution coverage. Graph 7 illustrates the position of the chapters within the textbook containing evolution topics. Graph 8 illustrates the percentage of page location of the evolution topics for the 1980's textbooks.

No textbook surveyed from the 1980's had a reference to special creation or creation science. All textbooks of the 1980's which were examined used the word *theory* when referring to evolution. The term *natural selection*, when used, referred only to the mechanism of evolution.

Textbooks of the 1990's

Five of the six textbooks of the 1990's which were examined explained the manner in which evolution was presented in the text. In the preface of Biology (Bernstein, 1990), the author advised teachers to instruct students that evolution is the process by which organisms change over time.

Milani in Biological Science: A Molecular Approach (1990) referred to the

theory of evolution in the following statements:

> The theory of evolution is basic to biology. The study of evolution permits biologists to make order out of the similarities and differences among living things. The theory of evolution is like other theories, a body of interrelated data. As new data are obtained, interpretations may change, but this does not mean the basic theory is unsound (p. T6).

In the forward to Biological Science: A Molecular Approach, a list of themes was given. Of the ten themes in the list, evolution was ranked first.

Modern Biology (Towle, 1991) stated, "Some teachers believe biology must be understood as an outgrowth of the evolutionary process" (p. T30). Towle suggested Modern Biology was well-suited to teaching biology with an evolutionary approach. In Towle's textbook, students were introduced to the concepts of evolution, phylogeny, and adaptation on page six, and most chapters of Towle's Modern Biology reflected the evolutionary theme. With only slight modifications in scope and sequence, Towle declared that Modern Biology could be used for the evolutionary approach to teaching biology.

In Biology (Miller and Levine, 1991) the authors stated the following concerning the theme of evolution in their textbook:

> We wanted to write a book that teaches evolutionary relationships among organisms. The editors stated biology teachers wanted us to make sure the book would take an evolutionary approach to biology. As you read through your book you will quickly discover that the marriage worked. You will also discover the topic of evolution is not confined to a single unit. Rather, evolution is presented as a unifying concept that interrelates all other areas of biology. In this way, evolution is interwoven throughout the textbook and provides a conceptual framework that often ties together seemingly unrelated areas of science (p. T6).

Biology: The Dynamics of Life (Biggs, Emmeluth, Gentry, Hays, Lundgren, and Mollura, 1991) viewed evolution as a vital theme to the development of a complete understanding of biology. These themes were emphasized by the phylogenetic approach each chapter took toward the different kingdoms of organisms.

Two textbook authors commented on their own inclusion of controversial subjects. The first textbook Biological Science: A Molecular Approach (Milani, 1990) listed several controversial topics including gene therapy, disposal of nuclear waste, management of water resources, and evolution. The example illustrating evolution was the debate between gradualism and punctuated equilibria. Neither debate called into question the validity of evolutionary theory. Gradualism was explained as an argument about the pace of evolutionary change while punctuated equilibria was determined as a disagreement over the sequence in which hominid ancestors diverged. According to Milani, "Controversy surrounding issues does not mean established values and traditions will necessarily be found wanting. We have not gone out of our way purposely to create controversy where none exists, but we have not avoided it" (p. T11).

Table 9
Percentage Of Textbook Devoted To Evolution --1990's

Textbook Name	Total Pages	Evolution Pages	Percentage
Biology(Bernstein-90)	647	48	7.42
Biological Science(Milani-90)	599	72	12.02
Modern Biology(Towle-91)	831	63	7.58
Biology(Miller-91)	1076	52	4.83
Biology(Biggs-91)	779	44	5.65
Biology Today(Goodman-91)	887	44	4.96
	Average	53.83	7.08

Biology (Miller and Levine, 1991), the second textbook examined which included a commentary on controversial subjects, contained a topic in the text called "Science and Human Values." In Biology the authors stated,

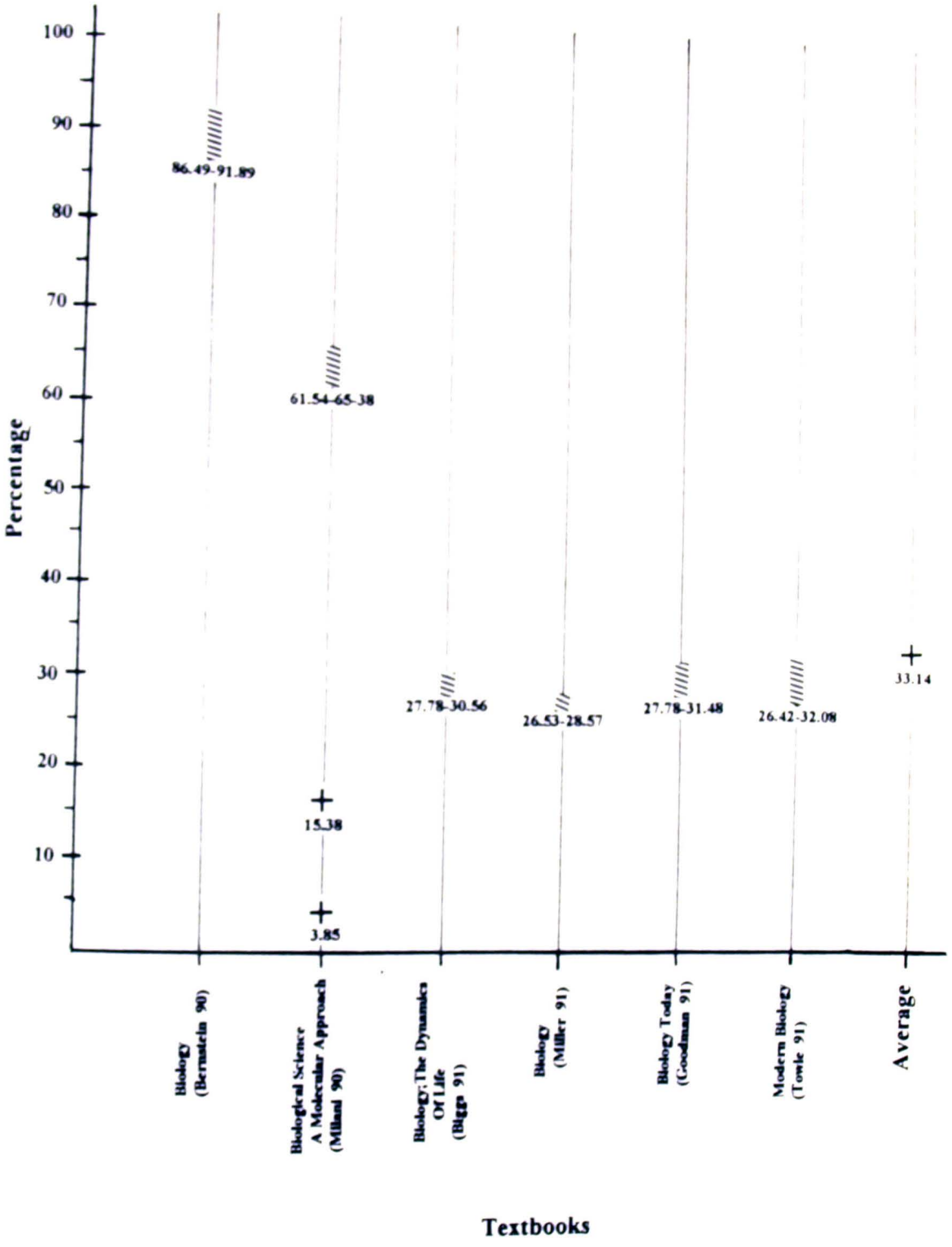
> An important goal in science is to be objective. But scientists are no different from the rest of us when it comes to emotions or personal opinions. Scientists have important things to say about health, society, and the environment. Should certain experiments involving humans be forbidden? Scientific data can be misinterpreted or misapplied by scientists who want to prove a particular point. Decisions made by scientists with personal prejudices may or may not be in the public interest. What this means to you is that understanding science is even more important today than ever before. If enough people understand the nature of science, the dangers posed by misinterpreted or misleading information will be reduced (p. 17).

Only in one textbook of the 1990's, Biological Science (Milani, 1990), was special creation mentioned. Milani believed special creation should be termed *pseudoscience*. A topic covering one and a half pages was entitled "Pseudoscience."

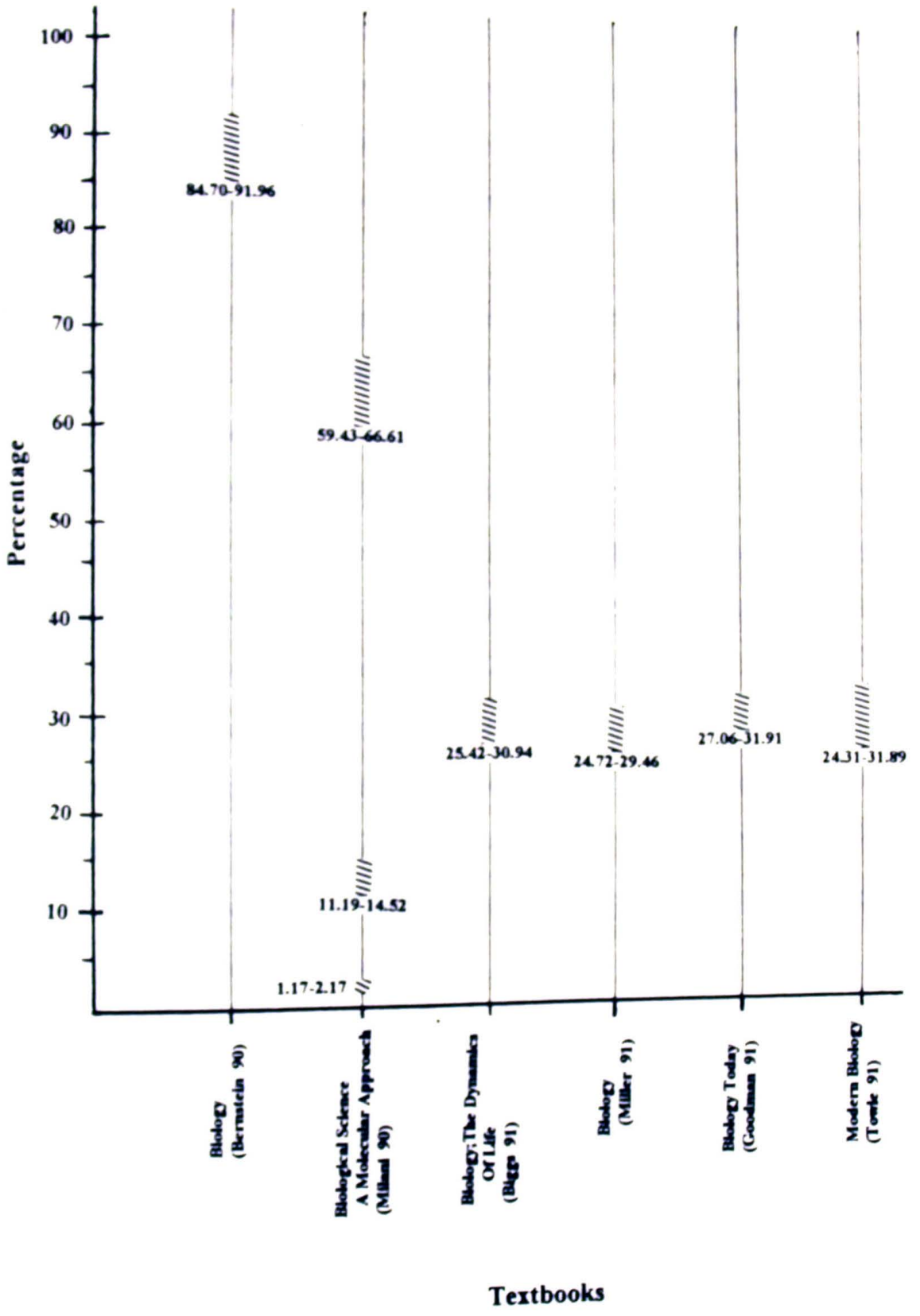
Table 10
Chapter Placement Of Evolution Within
The Biology Textbook--1990's

Textbook	Placement(Chapter or Section)
Biology(Bernstein-90)	32, 33, and 34 out of 37
Biological Science(Milani-90)	1, 4, 16, and 17 out of 26
Modern Biology(Towle-91)	14, 15, 16, and 17 out of 53
Biology(Miller-91)	13 and 14 out of 49
Biology(Biggs-91)	10 and 11 out of 36
Biology Today(Goodman-91)	15, 16, and 17 out of 54

Graph 9
Chapter Placement of Evolution Within Biology Textbooks–1990's



Graph 10
Text Placement of Evolution Within Biology Textbooks--1990's



Requiring science teachers to devote equal time to the teaching of evolution as well as creationism, the 1981 Arkansas Equal Time Law was discussed in Milani's textbook. In addition, Milani presented the 1987 Balanced Treatment Law in which the United States Supreme Court ruled unconstitutional a Louisiana law requiring the teaching of creationism whenever evolution theory was taught in science classrooms. Milani further stated,

> Creation science is not science because its working assumptions cannot be examined by scientific methods. The word creation is associated with religion and a supreme being. It is, therefore, a matter of faith, not of scientific investigation. Furthermore, creationists are not willing to modify their model even when observations fail to support it. That definition does not exclude creationism from a place in the school curriculum, but rather it strongly suggests creationism should be a religious belief and not as scientific theory co-equal with evolution theory (p. 15).

Other examples of pseudoscience were listed by Milani including astrology, many cancer "cures," some dieting programs, as well as health practices. The author further stated "A great deal of time, effort, and money can be saved by learning to evaluate pseudoscientific claims carefully" (p. 15-16).

Table 9 lists the percentage of the 1990's textbooks given to the coverage of evolution. The location of the chapter placement of evolution within each textbook is given in Table 10. Graph 9 gives the percentage location of the chapter placement of evolution in the 1990's textbooks. Graph 10 illustrates the location of the text placement of evolution within the textbook.

All six textbooks examined in the 1990's used the term *theory* in association with evolution. In these textbooks, a theory was generally defined as a model

explaining many current observations and predictions of future outcomes. However, any theory, no matter how well-established, might be changed or even discarded if new experiments and observations did not support the model (Towle, 1991).

Chapter 5

Summary and Conclusions

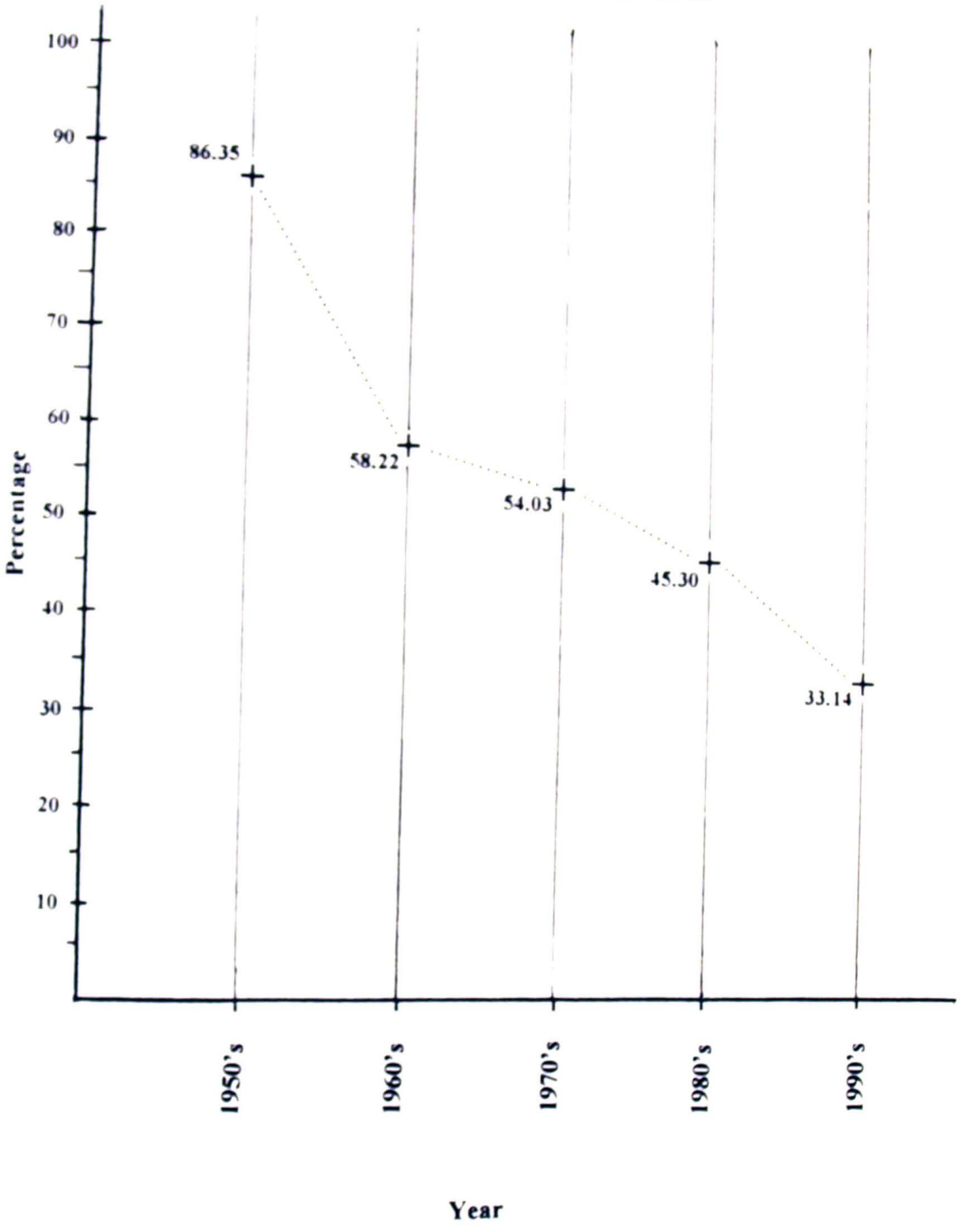
Summary of Textbooks of the 1950's

Graph 11 illustrates the averages for the chapter placement for the topic of evolution within the textbook. An average of 86.33 percent of the textbook would have to be covered before reaching the topic of evolution if the instructor followed a chapter-by-chapter approach.

Two of the three textbooks surveyed, Modern Biology (Moon, Mann, and Otto, 1956) and Exploring Biology (Smith, 1959) had only one chapter devoted to the subject of evolution while New Dynamic Biology (Baker, Mills, and Tancozs, 1959) used three chapters to cover the subject of evolution. New Dynamic Biology gave 5.30 percent of its subject matter to the topic of evolution while the least coverage of the topic of evolution was given by Modern Biology with only 1.82 percent.

The textbooks of the 1950's show the possibility of covering evolutionary topics without actually using the term *evolution*. The use of the terms *natural selection* or *survival of the fittest* in the three books covering evolution are illustrations of this point. New Dynamic Biology (Baker, Mills, and Tanczos, 1959) lists the five premises of natural selection. With the exception of minor word changes, these statements are the same statements which appear in later biology books. For example, in New Dynamic Biology the first statement about natural selection is "Every species of plant and animal tend to produce far more offspring than can possibly survive"(p. 446).

Graph 11
Summary of Chapter Placement
of Evolution Within Biology Textbooks



Biological Science: Molecules to Man (Welch, 1963, p. 75) and a later edition of Biological Science: Molecules to Man (Welch, 1968, p. 53) are the two textbooks of the 1960's which contain the most coverage of evolution. These two textbooks both begin their discussion of natural selection with the statement, "All organisms tend to increase in number at a geometric rate." Although the term *natural selection* and the ideas behind the term have been used by both conservative and liberal authors of the 1950's and 1960's, natural selection carries the same meaning for both sides of the evolutionary issue.

In addition, the textbook ranking second in the 1950's in overall coverage of evolution does not place emphasis upon the term *evolution*, but rather in Exploring Biology (Smith, 1959) evolution is considered a theory which is explained by the term *survival of the fittest*. Modern Biology (Moon, Mann, and Otto, 1956) is the most conservative of all textbooks surveyed. Devoting only thirteen pages of seven hundred and thirteen pages to the topic of evolution, Moon et al. paraphrases the five premises of natural selection by using only three to four words for each statement. His explanation includes "over-production of individuals, struggle for existence, variation among individuals, survival of the fittest, and inheritance of favorable characteristics" (p. 665).

From the placement of evolutionary topics within the textbook, the amount of coverage given to the subject of evolution and the lack of the use of the term *evolution* in the textbook, authors of the 1950's do not place much emphasis upon the theory of evolution. Additionally, explaining their position in the preface to the textbook or in the introduction to a given chapter concerning the manner of coverage of evolutionary topics in their textbooks did not appear to be important to the biology textbook authors of the 1950's.

Summary of Textbooks of the 1960's

The largest drop in chapter placement displayed in Graph 11 occurred between the 1960's and the 1950's. The decrease if facilitated by the introduction of the Biological Science Curriculum Study textbook series. Contributing to the decline, as well, is the changing of the authorship in Modern Biology from the conservative evolutionary approach of Moon, Mann, and Otto of the 1950's to the more liberal evolutionary views of Otto and Towle in the 1960's. The topic of evolution by the 1960's may be reached by first having to cover only 58.22 percent of the textbook, on the average, if the teacher taught the chapters consecutively. For example, by the 1960's, Otto and Towle have rearranged their Modern Biology textbook by changing the subject of evolution from Chapter 51 out of total of fifty-four chapters in the entire textbook to Chapter 13 out of a total of fifty-three chapters in the total textbook. With this distribution, a teacher would only have to cover 24.53 percent of the textbook if he or she is teaching chapters consecutively.

All of the BSCS textbooks of the 1960's which have been examined are above the average percentage of 7.34 in their percentage of coverage devoted to evolution as indicated by Table 3. The two textbooks entitled Biological Science: Molecules to Man (Welch, 1963) and Biological Science: Molecules to Man (Welch, 1968) are written from an evolutionary point of view. Both of Welch's textbooks have multiple chapters devoted to evolution placed throughout the textbook. Graph 3 displays the location of the seven chapters discussing evolutionary topics in the 1963 edition of Welch's textbook. Additionally, Graph 3 indicates four out of the five chapters devoted to evolutionary topics in the 1968 textbook are placed consecutively instead of being scattered throughout the textbook.

The BSCS Green Version of 1968, an ecological approach to the teaching of biology, contains two consecutive chapters dealing with evolution. Chapters 18 and 19 out of a total of twenty chapters speak of evolutionary topics. Four chapters on evolution are included in the BSCS Yellow Version of 1968. Published under the textbook name of Biological Science: An Inquiry Into Life (Meyer, 1968), the four chapters include Chapters 31, 32, 33, and 34 with almost eighty-four percent of the textbook having to be covered before reaching these chapters.

Table 1 and Table 3 illustrate a change in Ella Thea Smith's philosophy toward evolution. Her inclusion of evolution increases from 4.14 percent of her textbook in 1959 to 10.36 percent of the textbook in 1966 indicating an increase of 6.22 percent in her evolutionary coverage. The increase in percentage of coverage occurs because the 1966 Exploring Biology includes four chapters on evolution while her 1959 edition of the same textbook includes only one chapter on evolution.

During the 1960's, an upward trend in the inclusion of evolution within textbooks is noticed. The subject of evolution is also given added importance by the positioning of the subject to include the topic of evolution earlier in the students' study of biology. The average number of pages devoted to evolution doubled from 23.33 pages of the textbook included in a 1950's textbook to 46.83 pages devoted to evolutionary topics for a 1960's textbook.

Summary of Textbooks of the 1970's

Graph 11 exhibits a 1.83 percent increase in evolutionary coverage over the 1960's average coverage of topics devoted to evolution. Five of the thirteen textbooks surveyed have percentages of evolutionary coverage above the ten percent level. The highest percent of evolutionary coverage appears in Biology (Kimball,

1975) with 19.79 percent of the total textbook devoted to the subject of evolution. The 1973 and 1975 editions of Modern Biology (Otto and Towle) continue to be the most conservative dealing with evolutionary topics with averages of 2.67 percent and 2.11 percent of total coverage respectively. Most textbooks of the 1970's which have been surveyed tend to group the chapters covering evolution together in units or blocks rather than to scatter the chapters throughout the entire textbook. The only textbooks to include the topic of evolution positioned throughout the textbook in more than one location are the two BSCS Green Versions (Haynes, 1973 and 1978) and BSCS: Molecules to Man (Welch, 1973). Excluding Modern Biology, the only other textbook with only one chapter devoted to evolution is Biology: Patterns In Living Things (Morholt and Brandwein, 1976).

The average number of pages dedicated to evolution increased from 46.83 pages per textbook surveyed in the 1960's to 56.08 pages per textbook surveyed from the 1970's. Graph 11 demonstrates a small decrease in the percentage placement of evolution within the textbook. In the average textbook of the 1970's, teachers must only have covered 54.03 percent of the textbook before reaching evolutionary topics.

Textbooks peak in their percentage of evolutionary content in the 1970's. The BSCS: Molecules to Man (Welch, 1973) continues as the BSCS series have in its earlier textbooks to place the coverage of evolution near the beginning of the textbook more so than does any other textbook or series of textbooks. The only other BSCS textbooks surveyed for the 1970's are the 1973 edition and the 1978 edition of the BSCS Green Versions written almost entirely from an ecological viewpoint. Graph 5 illustrates the inclusion of the two chapters on both of the Green Versions of the BSCS series of textbooks. In each of the textbooks, Chapters 10 and 18 are devoted to evolution.

Summary of Textbooks of the 1980's

Graph 11 continues to demonstrate that chapter placement of evolution comes sooner within the body of biology textbooks than chapter placement comes in previous decades. The average placement for the eleven textbooks examined for the 1980's reveals that students could have been studying evolutionary topics by covering only 45.30 percent of the textbook.

Only one BSCS textbook, Biological Science: A Molecular Approach (Meyer, 1980), has been available for examination during the 1980's. With the change in editors of the BSCS Blue Version of which Biological Science: A Molecular Approach is a part, evolutionary topics have been brought closer to the beginning of the textbook than has previously been seen in the Welch (1973) textbook. The Meyer edition is the only textbook of the 1980's surveyed which contains a percentage of coverage above ten percent. At 16.73 percent, the Meyer textbook contains more than twice the amount of evolutionary topics than does any other textbook surveyed for the 1980's. Modern Biology (Otto and Towle, 1985) continues to present the lowest percentage of coverage of evolutionary topics with 2.69 percent.

Only two textbooks offer topics on evolution in more than one section of the textbook. Graph 8 illustrates a widening distance between authors willing to cover the topic early in the course of study as opposed to those textbook authors who continue to subscribe to the conservative view of placing the topic of evolution nearer the end of the textbook.

Graph 12 displays a marked decrease in the percentage of coverage of evolution in textbooks. Two factors may account for this decrease. As the protest groups, described by Sloan, Jenkinson, LaPota, and LaPota, have become more vocal in their actions, textbook authors and publishers have become more vocal in

their actions, textbook authors and publishers have begun to diminish their coverage of evolution. The fact only one BSCS textbook was available for evaluation could account for the second factor.

The authors of three textbooks of the 1980's have explained their approach to evolution by including such statements as, "All theories are tentative and await further modification and refinement" (Gottfried, Madrazo, Motz, Olenchalk, Sinclair, and Skoog, 1983, p. 11). "Every attempt has been made to provide scientific basis for the development of the theory [evolution]" (McLaren and Rotundo, 1983, p. 5T). Slesnick, Balzer, McCormick, Newton, and Rasmussen, (1985, p. 197) in Biology stated "This theory [evolution] is important because it explains so many observations that have been made about organisms both alive today and in the past."

Summary of Textbooks of the the 1990's

Graph 11 presents the continuing decrease in chapter placement in the amount of material covered before reaching the topic of evolution within the textbook. The topic of evolution in the six books reviewed may be achieved by covering only 33.14 percent of the textbook.

The most significant change occurring in the textbooks of the 1990's is the increased coverage of evolutionary topics in Modern Biology (Towle, 1991) from one chapter dealing with evolution in previous editions to four chapters in the 1991 edition in the treatment of evolution. Because of his more liberal viewpoint toward evolution than that of his former co-author James Otto, the author of the 1991 edition of Modern Biology Albert Towle may be attributed to the drastic change in the textbook's treatment of evolution. James Otto is the last of the co-authors to have worked with Truman Moon who is known for his conservative approach to the

treatment of evolution. As long as Otto and Towle have been in partnership, Otto has held the seniority status, and his views have been upheld. While Otto and Towle have co-authored the Modern Biology series of textbooks, the series has never given more than 2.73 percent of its coverage to evolution; however, with the retirement of Otto, Towle's textbook has given 7.58 percent of its treatment to the subject of evolutionary topics and has spanned four chapters instead of the former one chapter.

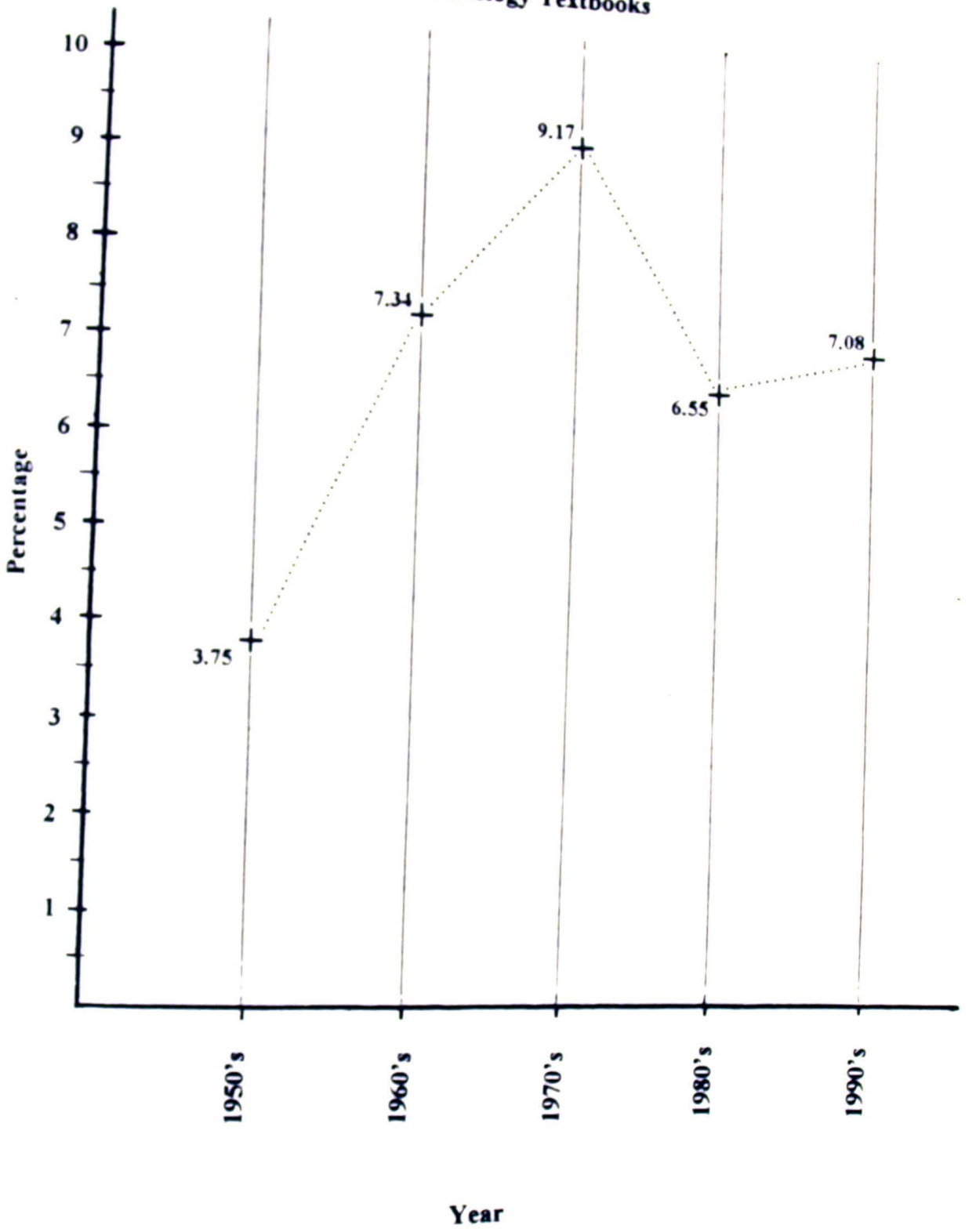
Graph 12 displays a slight increase in the percentage of coverage of evolution in the textbooks for the 1990's. As the People for the American Way organization has begun to exert its influence more verbally, publishers and authors have begun to include more coverage of evolution. The average number of pages devoted to evolution has increased by twelve pages over the 1980's average of 41.82 pages of evolutionary topics per textbook.

Conclusions

The content analysis of high school biology textbooks reveals for five decades the coverage of evolution has shown a marked progression of general acceptance by placing the controversial subject closer to the front of biology textbooks. For a subject which once was placed well within the body of the textbook, evolution may now be studied by first teaching only one-third of the textbook.

Moreover, the average number of pages devoted to the study of evolution has more than doubled when comparing the biology textbooks of the 1950's to the biology textbooks of the 1990's with an average of 23.33 pages in the 1950's to an average of 53.83 pages in the textbooks of the 1990's. Discoveries by paleontologists have no doubt provided more information for authors to build upon.

Graph 12
Percent Coverage of Education Within Biology Textbooks



When authors' viewpoints based upon these new discoveries have been placed within textbooks, an almost threefold rise in the percentage of evolutionary treatment has occurred per textbook. This sharp percentage increase has been influenced by the introduction on the market of textbooks written solely from an evolutionary point of view.

Some of these paleontological discoveries have produced authors' viewpoints which have been disconcerting to various facets of the general public including parent groups and textbook adoption committees. Because of protests from textbook adoption committees and groups opposed to the inclusion of certain controversial subjects in textbooks, the percentage of controversial coverage has declined in the 1980's due to many publishers' practicing self-censorship. Just as groups have arisen to protest the contents of biology textbooks, their antitheses are existing to protest, in their opinion, the lack of adequate coverage dealing with certain controversial subjects in textbooks.

With the formation in the 1980's of the organization the People for the American Way, more evolutionary treatment has begun to appear in biology textbooks. As PFAW has started issuing reports on textbooks to adoption committees concerning the textbooks' coverage of the topic of evolution, publishers who wish to establish good rapport with PFAW have begun to include more evolutionary coverage in their textbooks.

The mechanics of textbook publishing are indeed complex. Publishing companies may accept freelance manuscripts, or they may choose to promote authors to use the publishers' names. Materials which authors choose to include in their work and how they choose to include the materials in the textbooks are important monetarily to the publisher. Textbooks with viewpoints which are too liberal tend to be criticized by protest groups and, therefore, become burdens to textbook

publishers' names. Textbooks which lean toward conservative viewpoints may receive criticism from liberal organizations. The use of textbooks as viewed by adoption committees and parent groups is an important consideration for the publishing industry as well. All of these concerns affect the content of the tool which teachers use most in the classroom. This tool is the textbook.

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APPENDIX A

Textbooks Surveyed In The Study

Textbooks Surveyed

Textbooks of the 1950's

Moon, T., Mann, P., and Otto, J., (1956). Modern Biology. New York. Holt, Rinehart and Winston.

Lauby, C., Silvan, J., and Mork, G., (1958). Biology. New York. American.

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Textbooks of the 1980's

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APPENDIX B

Survey Data Collection Form

TextbookName_____

Author(s)_____

_____

Year_____Publisher_____

The theme of evolution as presented in the textbook is explained in the preface.

An explanation of how controversial subjects are covered is present in the preface.

Where is the placement of evolution within the text?

A. Chapter

B. Page

Number of pages devoted to evolution_____

Total pages in textbook_____

Percentage of textbook devoted to evolution_____

Is there a mention of special creation or creation science?

What is the reference toward evolution within the textbook?

VITA

Philip Ross Chadwick was born in Clarksville, Tennessee, on April, 1946. He attended the public schools of Montgomery County, Tennessee and graduated from Montgomery Central High School in May 1964. He entered Austin Peay State College in the summer of 1964. In May of 1968, he received a Bachelor of Science degree with a major in Biology. He reentered Austin Peay State University in March 1970 and in August 1975 received a Master of Science degree in Biology. In September 1994 he reentered Austin Peay State University and in May 1996 received an Education Specialist degree in Administration and Supervision.

He is married to Gladena (Dee) Griffin Chadwick, librarian at Dickson County Senior High School in Dickson, Tennessee. They are the parents of two sons Blake and Blair. He is presently employed by the Dickson County Board of Education as a biology teacher at Dickson County Senior High School in Dickson, Tennessee.